Naval Oceanographic Office

Stennis Space Center
MS 39522-5001

Technical Report
TR 314
April 1995

TR 314

THE JOINT US/UK 1995 EPOCH WORLD MAGNETIC MODEL

JOHN M. QUINN
RACHEL J. COLEMAN
DONALD L. SHIEL
JOHN M. NIGRO

FLEET PRODUCTS DIVISION

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JGK

Prepared under the authority of
Commander
Naval Meteorology and Oceanography Command

FOREWORD

The Earth's magnetic field continues to play an essential role in global navigation. All navigational aids or Attitude/Heading Reference Systems (AHRS), regardless of their operating principles, must speak a common language. That common language is in terms of the Earth's directional-field components, magnetic declination and magnetic inclination. Magnetic-related navigational aids are integrated, in the forms of computer hardware and software, into virtually every major weapons system of the Army, Air Force, Navy and Marines, as well as many North Atlantic Treaty Organization (NATO) systems. Most particularly, all Department of Defense sponsored Global Positioning System (GPS) receivers have the World Magnetic Model imbedded into them. In order to maintain optimum performance, these AHRS must be periodically updated with respect to the Earth's magnetic field, which is a dynamic entity that changes slowly but erratically with time.

For well over a century it has been the responsibility of the Naval Oceanographic Office to monitor the Earth's changing magnetic field and periodically report on these changes in the forms of magnetic charts and mathematical models. During the past forty-five years, this task has involved an intensive data collection effort through the Navy's Project MAGNET program and more recently through the Navy's Polar Orbiting Geomagnetic Survey (POGS) satellite program. The Navy's participation in this effort, however, will be discontinued as of 1 October 1995, at which time the World Magnetic Modeling program will be returned to its sponsor, the Defense Mapping Agency, for further disposition, while the rest of the Navy's magnetic data collection and analyses efforts will be discontinued. Extreme gratitude is expressed to all those who have participated in the Navy's magnetics program in general and its Project MAGNET program, which began in 1951, in particular.

This report is a comprehensive summary of the cooperative effort between the Naval Oceanographic Office and the British Geological Survey in producing the 1995 Epoch World Magnetic Model, WMM-95.

Dieter K. Rudolph

DIETER K. RUDOLPH
Captain, U. S. Navy
Commanding Officer

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. AGENCY USE ONLY *(Leave blank)*

2. REPORT DATE
April 1995

3. REPORT TYPE AND DATES COVERED
Technical Report

4. TITLE AND SUBTITLE
THE JOINT US/UK 1995 EPOCH WORLD MAGNETIC MODEL

5. FUNDING NUMBERS

6. AUTHOR(S)
John M. Quinn, Rachel J. Coleman, Donald L. Shiel,
and John M. Nigro

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
Commanding Officer
Naval Oceanographic Office
1002 Balch Boulevard
Stennis Space Center, MS 39522-5001

8. PERFORMING ORGANIZATION REPORT NUMBER
TR 314

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
Commander
Naval Meteorology and Oceanography Command
1020 Balch Boulevard
Stennis Space Center, MS 39529-5005

10. SPONSORING/MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution is unlimited.

12b. DISTRIBUTION CODE

13. ABSTRACT *(Maximum 200 words)*
This report contains a detailed summary of the data used, analyses performed, modeling techniques employed, and results obtained during the course of the 1995 Epoch World Magnetic Modeling effort. This report also contains the GEOMAG algorithm and describes its uses and limitations. Charts derived from the WMM-95 model and the GEOMAG algorithm for both the Main geomagnetic field components and their Secular Variations are presented on Mercator and polar stereographic projections. Additionally, the numerical values of the Main geomagnetic field components and their Secular Variations are tabulated on a 5-degree worldwide grid.

14. SUBJECT TERMS
Geomagnetics, World Magnetic Model, WMM-95, GEOMAG, POGS, Project MAGNET, 1995 Epoch, Spherical Harmonic

15. NUMBER OF PAGES
376

16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED	UL

ABSTRACT

The 1995 Epoch World Magnetic Model (WMM-95) is the product of a cooperative modeling effort between the United States Naval Oceanographic Office (NAVOCEANO) and the United Kingdom's British Geological Survey (BGS). The model is based on data from NAVOCEANO's Project MAGNET high-level ($\geq$ 15,000 ft.) vector-aeromagnetic surveys flown from 1988 to 1994, scalar total intensity data collected from NAVOCEANO's Polar Orbiting Geomagnetic Survey (POGS) satellite during the period 1991 through 1993, and all available magnetic observatory vector annual-means and repeat station data supplied by countries around the world. The WMM-95 model describes that portion of the geomagnetic field generated within the Earth's liquid core. It is presented in terms of one set of spherical harmonic coefficients which characterize the Earth's Main magnetic field at the fixed epoch 1995.0 and a second set of spherical harmonic coefficients which *predict* the Secular Variation (i.e., slow temporal change) of the Earth's Main magnetic field between 1995.0 and 2000.0. These coefficients (Main and Secular Variation) are collectively called Gauss coefficients in honor of the German scientist Carl Frederick Gauss, who in 1834 created the first spherical-harmonic, geomagnetic field model and used it to show that the bulk of the geomagnetic field originated below the Earth's surface.

This report contains a detailed summary of the data used, analyses performed, modeling techniques employed, and results obtained during the course of the 1995 Epoch World Magnetic Modeling effort. This report also contains the GEOMAG algorithm and describes its uses and limitations. Charts derived from the WMM-95 model and the GEOMAG algorithm for both the Main geomagnetic field components and their Secular Variations are presented on Mercator and polar stereographic projections. Additionally, the numerical values of the Main geomagnetic field components and their Secular Variations are tabulated on a 5-degree worldwide grid.

The Defense Mapping Agency's Hydrographic/Topographic Center (DMA/HTC) publishes wall-sized charts of the Total Intensity, Declination, Inclination, and the Horizontal and Vertical geomagnetic field components and their respective secular variations on Mercator and polar stereographic projections.

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THE 1995 EPOCH GEOMAGNETIC MODEL AND THE GEOMAG ALGORITHM

1.0 Introduction

The Earth's magnetic field, as measured by a magnetic sensor on or above the Earth's surface, is actually a composite of several magnetic fields generated by a variety of sources. These fields are superimposed onto each other and, through inductive processes, interact with each other. The most important of these geomagnetic sources are:

a. the Earth's conducting, fluid outer core;
b. the Earth's crust/upper mantle;
c. the ionosphere; and
d. the magnetosphere.

More than 90 percent of the geomagnetic field is generated by the Earth's outer core. It is this portion of the geomagnetic field that is represented by the 1995 Epoch World Magnetic Model (WMM-95). Those portions of the geomagnetic field not represented by the model are collectively referred to as the *anomalous* geomagnetic field, which varies both spatially and temporally with respect to the model.

The model itself consists of a degree and order 12 spherical-harmonic Main (i.e., core-generated) Field (MF) model comprised of 168 spherical-harmonic Gauss coefficients and a degree and order 12 spherical-harmonic Secular-Variation (SV) (core-generated, slow temporal variation) field model comprised of an additional 168 spherical-harmonic Gauss coefficients. As in previous World Magnetic Models, the 1995.0 *Predictive* SV Gauss coefficients corresponding to degree and order 9, or larger, were set to zero due to a lack of data.

The primary geomagnetic data set for the 1995 Epoch MF model is the Polar Orbiting Geomagnetic Survey (POGS) satellite data set, which provided long-term Total Intensity data from 1991 through 1993. This data set was supplemented by Project MAGNET vector-aeromagnetic data, which spanned the period from 1988 through 1993. These two data sets and the geomagnetic observatory annual means data set also provided sufficient spatial and temporal coverage to permit, for the first time, the computation of the *Definitive* SV Gauss coefficients to the full degree and order 12 for the definitive 1992.5 Epoch SV model, which in turn played a key role in determining the 1995 Epoch MF model coefficients.

The MF Gauss coefficients characterize the geomagnetic field at one instant of time called the *base epoch*, which for WMM-95 is 1995.0. The *predictive* SV coefficients characterize the slow rate of change of the geomagnetic field for the 5-year period from the base epoch to the *termination epoch*, which for WMM-95 is 2000.0, at which time, WMM-95 will be replaced by WMM-2000. The magnetic field components are computed via the magnetic variation algorithm (GEOMAG), which is a FORTRAN (also translated into C, ADA, and other high-level languages) subroutine that uses the WMM Gauss coefficients in conjunction with the spherical-harmonic expansions associated with each field component.

The WMM coefficients are produced jointly by the British Geological Survey (BGS) in Edinburgh, Scotland, and the Naval Oceanographic Office (NAVOCEANO) at Stennis Space Center, Mississippi, on behalf of the British Hydrographic Office in Taunton, England, and the

Defense Mapping Agency (DMA), Washington, D.C. The model, associated software, and documentation are distributed by NAVOCEANO on behalf of DMA in accordance with DMA Instructions 8000.1 and 8000.2. These models are produced at 5-year intervals, as are DMA's Declination/Grid-Variation charts, while charts of the other geomagnetic components are published by DMA every 10 years. The 1995.0 Epoch corresponds to a 10-year interval when all of the geomagnetic components will be published in chart form by DMA. The military specifications for the WMM are contained in MIL-W-89500 (DMA [1993]). Magnetic model requirements that are more stringent than those set forth in this military specification (e.g., those which must include magnetic effects of the Earth's crust, ionosphere, or magnetosphere and/or require greater spatial or temporal resolution on a global, regional, or local basis) should be addressed to:

Director, Defense Mapping Agency
8613 Lee Highway
Fairfax, VA 22031-2137
ATTN: PR, ST A-13

It is extremely important to recognize that the WMM series of geomagnetic models and the charts produced from these models characterize only that portion of the Earth's magnetic field which is generated by the Earth's fluid outer core. The portions of the geomagnetic field generated by the Earth's crust, upper mantle, ionosphere, and magnetosphere are not represented in these models. Consequently, a magnetic sensor such as a compass or magnetometer may observe spatial and temporal magnetic anomalies when referenced to the appropriate WMM. In particular, certain local, regional, and temporal magnetic declination anomalies can exceed 10 degrees. Anomalies of this magnitude are not common but they do exist. Declination anomalies on the order of 3 or 4 degrees are not uncommon but are of small, spatial extent and are relatively isolated. On land, spatial anomalies are produced by mountain ranges; ore deposits; ground struck by lightning; geological faults; and cultural features such as trains, planes, tanks, railroad tracks, power lines, etc. In ocean areas these anomalies occur most frequently along continental margins; near seamounts; and near ocean ridges, trenches, and fault zones, particularly those of volcanic origin. Ships and submarines are also sources of magnetic anomalies in the ocean.

Temporal anomalies over either ocean or land areas can last from a few minutes to several days and are produced by ionospheric and magnetospheric processes which are driven by the *solar wind*. In particular, *magnetic storms* generated by *solar flares* and other solar activity can, through modulation of the solar wind, cause severe and persistent magnetic anomalies in the Earth's environment. Even during periods of quiet solar activity, significant spatial and temporal magnetic anomalies are found in the polar and equatorial regions of the Earth, where magnetic fields produced by ionospheric current systems, such as the *auroral electrojets* and the *equatorial electrojet*, are always present. Most sources of magnetic anomalies are comparatively isolated in either space or time. Therefore, from a global perspective, the WMM-95 root-mean-square (RMS) Declination (D), Inclination (I), and Grid Variation (GV) errors of the WMM are estimated to be less than 0.5 degrees in ocean areas and less than 1.0 degree over land areas at the Earth's surface over the entire 5-year life of a particular model. Also, the RMS errors at sea level for the full 5-year life of the WMM-95 model for the

Horizontal Intensity (H) and the Vertical component (Z), over the oceans, are estimated to be less than 200 nanoTeslas (nT), while for the Total Intensity (F) the RMS error is estimated to be less than 280 nanoTeslas. Over land areas the H, Z, and F components may be somewhat larger and are more difficult to determine. So, estimates for these are not given.

1.1 The Mathematical Model

The Earth's core-generated magnetic field has associated with it a geomagnetic potential $V(r,\theta,\varphi,t)$, which can be expressed in spherical coordinates in terms of a spherical-harmonic expansion of the following form:

$$V(r,\theta,\varphi,t) = R_E \sum_{n=1}^{N} \left(\frac{R_E}{r}\right)^{n+1} \sum_{m=0}^{n} \{g_{nm}(t)\cos(m\varphi) + h_{nm}(t)\sin(m\varphi)\} P_n^m(\theta) \qquad (1)$$

where the spherical coordinates (r,θ,φ) correspond to the radius from the center of the Earth, the colatitude (i.e., 90^0 - latitude), and the longitude. R_E is the mean radius of the Earth (6371.2 km); $g_{nm}(t)$ and $h_{nm}(t)$ are referred to as the Gauss coefficients at time t, where t is the time in years (e.g., 1997.312). $P_n^m(\theta)$ represents a particular Schmidt-normalized associated Legendre polynomial of spherical-harmonic degree n and order m. These are polynomials in terms of the cosine of the colatitude θ. The Gauss coefficients are slowly varying functions of time and are expressed in the form of a Taylor series expansion, where only terms up to first order in time are retained so that:

$$g_{nm}(t) = g_{nm}(T_{Epoch}) + \dot{g}_{nm}(t - T_{Epoch}) \qquad T_{Epoch} \le t \le T_{Epoch} + 5 \qquad (2a)$$

$$h_{nm}(t) = h_{nm}(T_{Epoch}) + \dot{h}_{nm}(t - T_{Epoch}) \qquad T_{Epoch} \le t \le T_{Epoch} + 5 \qquad (2b)$$

where T_{Epoch} is the base epoch of the model, which for WMM-95 is 1995.0. Thus, $g_{nm}(T_{Epoch})$ and $h_{nm}(T_{Epoch})$ are the Schmidt-normalized Gauss coefficients of the WMM at the model's base epoch, while the Schmidt-normalized SV Gauss coefficients, $\dot{g}_{nm}$ and $\dot{h}_{nm}$ (pronounced g_{nm} dot and h_{nm} dot, where the dot represents differentiation with respect to time: $\frac{d}{dt}$), are the annual rates of change of the MF Gauss coefficients g_{nm} and h_{nm} and are evaluated at the middle of the model's lifespan (i.e., at $T_{Epoch} + 2.5$). The MF Gauss coefficients and SV field Gauss coefficients are collectively referred to as spherical-harmonic coefficients.

Taking the time derivative of eq. (1) yields the spherical-harmonic expression for the Secular-Variation $\dot{V}(r,\theta,\varphi,t)$ of the geomagnetic potential:

$$\dot{V}(r,\theta,\varphi,t) = R_E \sum_{n=1}^{N} \left(\frac{R_E}{r}\right)^{n+1} \sum_{m=0}^{n} \left\{\dot{g}_{nm}(t)\cos(m\varphi) + \dot{h}_{nm}(t)\sin(m\varphi)\right\} P_n^m(\theta) \qquad (3)$$

which, due to the assumption that the MF Gauss coefficients vary linearly with time during the course of a 5-year interval, as expressed by eqs. (2a) and (2b), is approximately time independent over this short time span. The maximum degree N of the spherical-harmonic expansions in eqs. (1) and (3) is equal to 12. This value is determined by noting that when the spectral density of the MF Gauss coefficients is plotted as a function of harmonic degree, a distinct break in this density function occurs between degree 12 and degree 15. This is interpreted to mean that the low-degree harmonics corresponding to $N \leq 12$ are dominated by core-generated magnetic fields, while those high-degree harmonics for which $N \geq 15$ are dominated by fields generated within the crust and upper mantle. These fields are primarily associated with permanent and induced magnetization. This magnetization is limited to depths for which the ambient temperature does not exceed the Curie temperature. Spherical-harmonic degrees 13 and 14 correspond to a transition region where neither magnetic fields generated within the Earth's fluid core nor those generated within the Earth's crust dominate. We therefore use $N = 12$ as the spherical-harmonic cutoff which permits the best description of the core-generated magnetic field and its slow temporal change. This means that the shortest wavelength contained in the model is:

$$\lambda_{\min} = \frac{2\pi R_E}{N} = 3336\ km \tag{4}$$

Thus, the WMM is a low-resolution model. High-resolution (short wavelength) descriptions of that part of the magnetic field generated by the Earth's upper crust are better characterized via rectangular harmonic modeling of small local areas (Quinn and Shiel [1993]), while intermediate wavelength descriptions of the Earth's magnetic field generated by the lower crust and upper mantle are best characterized via spherical-cap harmonic models of large regional areas (Haines [1985a, 1985b, 1985c, and 1990]). Global geomagnetic data sets currently available do not support high-resolution (i.e., $\lambda \leq 500$ km) models and only marginally support intermediate-resolution (i.e., 500 km $< \lambda <$ 3336 km) magnetic field modeling. Special local and/or regional magnetic surveys are required to generate intermediate-resolution and high-resolution geomagnetic models. Consequently, there are some applications for which the use of the WMM will be entirely inadequate.

The Earth's magnetic field $\mathbf{B}(r,\theta,\varphi,t)$ is a vector quantity having three components which correspond to the projection of the magnetic field vector onto the three coordinate axes. Thus, $B_r(r,\theta,\varphi,t)$ is that portion of the field pointing radially outward from the Earth's center (i.e., perpendicular to the surface of the Earth); $B_\theta(r,\theta,\varphi,t)$ is that portion of the field pointing locally due south; and $B_\varphi(r,\theta,\varphi,t)$ is that portion of the field pointing locally due east. The magnetic field vector can be computed from the geomagnetic potential by taking its negative gradient, thus:

$$\mathbf{B}(r,\theta,\varphi,t) = -\nabla V(r,\theta,\varphi,t) \tag{5}$$

Consequently, the magnetic field components are related to the geomagnetic potential as follows:

$$B_r(r,\theta,\varphi,t) \;=\; -\;\frac{\partial V(r,\theta,\varphi,t)}{\partial r} \tag{6a}$$

$$B_\theta(r,\theta,\varphi,t) \;=\; -\;\frac{1}{r}\,\frac{\partial V(r,\theta,\varphi,t)}{\partial \theta} \tag{6b}$$

$$B_\varphi(r,\theta,\varphi,t) \;=\; -\;\frac{1}{r\sin\theta}\,\frac{\partial V(r,\theta,\varphi,t)}{\partial \varphi} \tag{6c}$$

which yield the following spherical-harmonic expansions:

$$B_r(r,\theta,\varphi,t) \;=\; \sum_{n=1}^{N}(n+1)\left(\frac{R_E}{r}\right)^{n+2}\sum_{m=0}^{n}\{g_{nm}(t)\cos(m\,\varphi) \;+\; h_{nm}(t)\sin(m\,\varphi)\}P_n^m(\theta) \tag{7a}$$

$$B_\theta(r,\theta,\varphi,t) \;=\; -\sum_{n=1}^{N}\left(\frac{R_E}{r}\right)^{n+2}\sum_{m=0}^{n}\{g_{nm}(t)\cos(m\,\varphi) \;+\; h_{nm}(t)\sin(m\,\varphi)\}\,\frac{dP_n^m(\theta)}{d\theta} \tag{7b}$$

$$B_\varphi(r,\theta,\varphi,t) \;=\; \frac{1}{\sin\theta}\sum_{n=1}^{N}\left(\frac{R_E}{r}\right)^{n+2}\sum_{m=0}^{n} m\,\{g_{nm}(t)\sin(m\,\varphi) \;-\; h_{nm}(t)\cos(m\,\varphi)\}P_n^m(\theta) \tag{7c}$$

These expressions are solutions of the Laplace equation, which in turn is derived from Maxwell's famous electromagnetic field equations under the assumptions that the magnetic field exists in a source-free region (i.e., no charges or currents are present), and that the fields are slowly varying.

Similarly, for the geomagnetic SV field we have:

$$\dot{\mathbf{B}}(r,\theta,\varphi,t) \;=\; -\,\nabla\,\dot{V}(r,\theta,\varphi,t) \tag{8}$$

so that:

$$\dot{B}_r(r,\theta,\varphi,t) \;=\; -\frac{\partial \dot{V}(r,\theta,\varphi,t)}{\partial r} \tag{9a}$$

$$\dot{B}_\theta(r,\theta,\varphi,t) \;=\; -\frac{1}{r}\,\frac{\partial \dot{V}(r,\theta,\varphi,t)}{\partial \theta} \tag{9b}$$

$$\dot{B}_\varphi(r,\theta,\varphi,t) \;=\; -\frac{1}{r\sin\theta}\,\frac{\partial \dot{V}(r,\theta,\varphi,t)}{\partial \varphi} \tag{9c}$$

which yield the following spherical-harmonic expressions:

$$\dot{B}_r(r,\theta,\varphi,t) = \sum_{n=1}^{N}(n+1)\left(\frac{R_E}{r}\right)^{n+2}\sum_{m=0}^{n}\left\{\dot{g}_{nm}(t)\cos(m\varphi) + \dot{h}_{nm}(t)\sin(m\varphi)\right\}P_n^m(\theta) \quad (10a)$$

$$\dot{B}_\theta(r,\theta,\varphi,t) = -\sum_{n=1}^{N}\left(\frac{R_E}{r}\right)^{n+2}\sum_{m=0}^{n}\left\{\dot{g}_{nm}(t)\cos(m\varphi) + \dot{h}_{nm}(t)\sin(m\varphi)\right\}\frac{dP_n^m(\theta)}{d\theta} \quad (10b)$$

$$\dot{B}_\varphi(r,\theta,\varphi,t) = \frac{1}{\sin\theta}\sum_{n=1}^{N}\left(\frac{R_E}{r}\right)^{n+2}\sum_{m=0}^{n} m\left\{\dot{g}_{nm}(t)\sin(m\varphi) - \dot{h}_{nm}(t)\cos(m\varphi)\right\}P_n^m(\theta) \quad (10c)$$

1.2 Spherical-Harmonic Normalization

The Gauss coefficients $g_{nm}(t)$, $h_{nm}(t)$, $\dot{g}_{nm}(t)$, and $\dot{h}_{nm}(t)$, as well as the associated Legendre polynomials and their derivatives, are Schmidt normalized by international agreement (circa 1930) of the International Union of Geodesy and Geophysics (IUGG). This particular normalization allows one to determine which spherical-harmonic terms of a particular model are the most significant simply by a cursory inspection of the model coefficients' relative magnitudes. The Schmidt-normalized associated Legendre polynomials $P_n^m(\theta)$ are related to the unnormalized associated Legendre polynomials $P^{nm}(\theta)$ (note position of indices) by the following relation:

$$P_n^m(\theta) = S^{nm}P^{nm}(\theta) \quad (11)$$

The Schmidt normalization factors S^{nm} and the unnormalized associated Legendre polynomials $P^{nm}(\theta)$ are computed via recurrence relations as follows (Cain et al., 1967):

$$P^{00}(\theta) = 1 \quad (12a)$$

$$P^{nm}(\theta) = \sin\theta\, P^{n-1,m-1}(\theta) \qquad m = n \neq 0 \quad (12b)$$

$$P^{nm}(\theta) = \cos\theta\, P^{n-1,m}(\theta) - \kappa^{nm}P^{n-2,m}(\theta) \qquad m \neq n,\ n \geq 1 \quad (12c)$$

$$\frac{dP^{00}(\theta)}{d\theta} = 0 \quad (12d)$$

$$\frac{dP^{nm}(\theta)}{d\theta} = \sin\theta\,\frac{dP^{n-1,m-1}(\theta)}{d\theta} + \cos\theta\, P^{n-1,m-1}(\theta) \qquad m = n \neq 0 \quad (12e)$$

$$\frac{dP^{nm}(\theta)}{d\theta} = \cos\theta \frac{dP^{n-1,m}(\theta)}{d\theta} - \sin\theta P^{n-1,m}(\theta) - \kappa^{nm} \frac{dP^{n-2,m}(\theta)}{d\theta} \qquad m \neq n, n \geq 1 \qquad (12f)$$

where:

$$\kappa^{nm} = \frac{(n-1)^2 - m^2}{(2n-1)(2n-3)} \qquad (13)$$

and where it is understood that the undefined polynomial $P^{1,0}(\theta)$ and its derivatives are set equal to zero. Similarly:

$$S^{00} = 1 \qquad (14a)$$

$$S^{n0} = \left(\frac{2n-1}{n}\right) S^{n-1,0} \qquad n > 0 \qquad (14b)$$

$$S^{nm} = \sqrt{\frac{(n-m+1)J}{n+m}}\, S^{n,m-1} \qquad \left\{ \begin{array}{l} J = 2 \;\; for \;\; m = 1 \\ J = 1 \;\; for \;\; m > 1 \end{array} \right\} \qquad (14c)$$

Also computed via recursion relations are the longitudinally dependent functions $cos(m\varphi)$ and $sin(m\varphi)$. They are computed as follows:

$$\sin(m\varphi) = 0 \qquad m = 0 \qquad (15a)$$

$$\cos(m\varphi) = 1 \qquad m = 0 \qquad (15b)$$

$$\sin(m\varphi) = \sin(\varphi)\cos[(m-1)\varphi] + \cos(\varphi)\sin[(m-1)\varphi] \qquad m > 0 \qquad (15c)$$

$$\cos(m\varphi) = \cos(\varphi)\cos[(m-1)\varphi] - \sin(\varphi)\sin[(m-1)\varphi] \qquad m > 0 \qquad (15d)$$

1.3 Coordinate Transformations

Although the magnetic field model is defined in terms of *spherical* coordinates, the intended application is in *geodetic* coordinates. So, a coordinate transformation is necessary (Cain et al., 1967). The 1984 World Geodetic System (WGS-84) (DMA [1991]) and its corresponding ellipsoid are used as the reference datum for this purpose. Computing the magnetic field components at a given location expressed in geodetic coordinates using the WMM-95 model is a three-step procedure:

a. Convert the geodetic latitude, longitude, and altitude (λ,φ,h) to spherical coordinates (r,θ,φ).

b. Compute the magnetic field components $B_r(r,\theta,\varphi,t)$, $B_\theta(r,\theta,\varphi,t)$, and $B_\varphi(r,\theta,\varphi,t)$.

c. Rotate the magnetic field components from spherical coordinates back to geodetic coordinates, thus yielding the magnetic field components $B_X(\lambda,\varphi,h,t)$, $B_Y(\lambda,\varphi,h,t)$, and $B_Z(\lambda,\varphi,h,t)$, which are projections of the magnetic field vector $\mathbf{B}(\lambda,\varphi,h,t)$ onto the **X**-north, **Y**-east, and **Z**-vertically down coordinate axes of the local rectangular coordinate system defined by the tangent plane to the ellipsoid, which is concentric about the WGS-84 ellipsoid and which encompasses the point (λ,φ,h).

The transformations corresponding to *step a* are as follows:

$$\cos\theta = \frac{\sin\lambda}{\sqrt{Q^2 \cos^2\lambda + \sin^2\lambda}} \tag{16a}$$

$$\sin\theta = \sqrt{1-\cos^2\theta} \tag{16b}$$

where, if a and b are respectively the semi-major and semi-minor axes of the WGS-84 ellipsoid, then:

$$Q = \frac{h\sqrt{a^2-(a^2-b^2)\sin^2\lambda} + a^2}{h\sqrt{a^2-(a^2-b^2)\sin^2\lambda} + b^2} \tag{17}$$

Furthermore:

$$r^2 = h^2 + 2h\sqrt{a^2 - (a^2 - b^2)\sin^2\lambda} + \frac{a^4-(a^4-b^4)\sin^2\lambda}{a^2-(a^2-b^2)\sin^2\lambda} \tag{18}$$

The transformations corresponding to *step c* depend on the angle α through which the magnetic field vector must be rotated while transforming from spherical to geodetic coordinates. This rotation angle is defined by the following transformation equations:

$$\cos\alpha = \frac{h + \sqrt{a^2\cos^2\lambda + b^2\sin^2\lambda}}{r} \tag{19a}$$

$$\sin\alpha = \frac{(a^2-b^2)\cos\lambda\sin\lambda}{r\sqrt{a^2\cos^2 + b^2\sin^2\lambda}} \tag{19b}$$

$$\alpha = \lambda + \theta - \frac{\pi}{2} \tag{19c}$$

Consequently, the components of the magnetic field vector in geodetic coordinates may be computed as follows:

$$B_X(\lambda, \varphi, h, t) \;=\; -\cos\alpha\, B_\theta(r, \theta, \varphi, t) \;-\; \sin\alpha\, B_r(r, \theta, \varphi, t) \tag{20a}$$

$$B_Y(\lambda, \varphi, h, t) \;=\; B_\varphi(r, \theta, \varphi, t) \tag{20b}$$

$$B_Z(\lambda, \varphi, h, t) \;=\; \sin\alpha\, B_\theta(r, \theta, \varphi, t) \;-\; \cos\alpha\, B_r(r, \theta, \varphi, t) \tag{20c}$$

From these three rectangular geomagnetic field components, it is possible to compute all others. In particular, the following magnetic components can be computed:

$$B_H(\lambda, \varphi, h, t) \;=\; \sqrt{B_X^2(\lambda, \varphi, h, t) \;+\; B_Y^2(\lambda, \varphi, h, t)} \qquad \text{(Horizontal Intensity)} \tag{21a}$$

$$B_F(\lambda, \varphi, h, t) \;=\; \sqrt{B_H^2(\lambda, \varphi, h, t) \;+\; B_Z^2(\lambda, \varphi, h, t)} \qquad \text{(Total Intensity)} \tag{21b}$$

$$B_D(\lambda, \varphi, h, t) \;=\; \tan^{-1}\left\{\frac{B_Y(\lambda,\varphi,h,t)}{B_X(\lambda,\varphi,h,t)}\right\} \qquad \text{(Declination)} \tag{21c}$$

$$B_I(\lambda, \varphi, h, t) \;=\; \tan^{-1}\left\{\frac{B_Z(\lambda,\varphi,h,t)}{B_H(\lambda,\varphi,h,t)}\right\} \qquad \text{(Inclination)} \tag{21d}$$

$$B_G(\lambda, \varphi, h, t) = \left\{\begin{array}{lc} B_D \;-\; \varphi & \lambda \geq 0 \\ B_D \;+\; \varphi & \lambda < 0 \end{array}\right\} \qquad \text{(Grid Variation)} \tag{21e}$$

Inclination is often referred to as the *Dip* angle, while the magnetic declination is sometimes referred to as the *magnetic variation*. Frequently, the magnetic field components in eqs. (21a) through (21e) are simply referred to in terms of their subscripts: X, Y, Z, H, F, D, I, and G. The Total Magnetic Intensity is sometimes referred to as *TI*, while the Grid Variation is sometimes referred to as *GV*. Some additional and quite useful relationships among these magnetic field components are:

$$H(\lambda, \varphi, h, t) \;=\; F(\lambda, \varphi, h, t)\, \cos[I(\lambda, \varphi, h, t)] \tag{22a}$$

$$X(\lambda, \varphi, h, t) \;=\; H(\lambda, \varphi, h, t)\, \cos[D(\lambda, \varphi, h, t)] \tag{22b}$$

$$Y(\lambda, \varphi, h, t) \;=\; H(\lambda, \varphi, h, t)\, \sin[D(\lambda, \varphi, h, t)] \tag{22c}$$

$$Z(\lambda, \varphi, h, t) = F(\lambda, \varphi, h, t) \sin[I(\lambda, \varphi, h, t)] \tag{22d}$$

1.4 The GEOMAG Algorithm

The Main Field Gauss coefficients at the base epoch, T_{Epoch}, are stored in array C of the GEOMAG algorithm (sometimes referred to as the MAGVAR algorithm), which is listed in the appendix, such that the lower half of array C is occupied by those Gauss coefficients $g_{nm}(T_{Epoch})$ corresponding to the *cosine* terms in the potential function of eq. (1), while the upper half of array C is occupied by those Gauss coefficients $h_{nm}(T_{Epoch})$ corresponding to the *sine* terms in eq. (1). Table 1 illustrates the details of this storage scheme, which is equivalent to the following mathematical assignments:

$$C_{nm} = \begin{Bmatrix} g_{nm} & m \le n \\ h_{m,n+1} & m > n \end{Bmatrix}$$

(23)

which implies that:

$$g_{nm} = C_{nm} \qquad m \le n \tag{24a}$$

$$h_{nm} = C_{m-1,n} \qquad m \le n, \quad m \ne 0 \tag{24b}$$

The Secular-Variation Gauss coefficients which describe the Main Field's slow annual change are stored in array CD (which stands for $\dot{C}$ [pronounced C dot]) such that the lower half of array CD is occupied by the Gauss coefficients $\dot{g}_{nm}$, which correspond to the *cosine* terms in eq. (3), while the upper half of the array is occupied by the Gauss coefficients $\dot{h}_{nm}$, corresponding to the *sine* terms in eq. (3). Table 2 illustrates the details of this storage scheme for array CD. It takes essentially the same form as table 1 for array C and corresponds to the following mathematical assignments:

$$\dot{C}_{nm} = \begin{Bmatrix} \dot{g}_{nm} & m \le n \\ \dot{h}_{m,n+1} & m > n \end{Bmatrix} \tag{25}$$

which implies that:

$$\dot{g}_{nm} = \dot{C}_{nm} \qquad m \le n \tag{26a}$$

$$\dot{h}_{nm} = \dot{C}_{m-1,n} \qquad m \le n, \quad m \ne 0 \tag{26b}$$

Table 1. Arrangement of Main Field Coefficients in Array C_{nm}

n\m	0	1	2	3	4	5	6	7	8	9	10	11	12
0	g_{00}	h_{11}	h_{21}	h_{31}	h_{41}	h_{51}	h_{61}	h_{71}	h_{81}	h_{91}	$h_{10,1}$	$h_{11,1}$	$h_{12,1}$
1	g_{10}	g_{11}	h_{22}	h_{32}	h_{42}	h_{52}	h_{62}	h_{72}	h_{82}	h_{92}	$h_{10,2}$	$h_{11,2}$	$h_{12,2}$
2	g_{20}	g_{21}	g_{22}	h_{33}	h_{43}	h_{53}	h_{63}	h_{73}	h_{83}	h_{93}	$h_{10,3}$	$h_{11,3}$	$h_{12,3}$
3	g_{30}	g_{31}	g_{32}	g_{33}	h_{44}	h_{54}	h_{64}	h_{74}	h_{84}	h_{94}	$h_{10,4}$	$h_{11,4}$	$h_{12,4}$
4	g_{40}	g_{41}	g_{42}	g_{43}	g_{44}	h_{55}	h_{65}	h_{75}	h_{85}	h_{95}	$h_{10,5}$	$h_{11,5}$	$h_{12,5}$
5	g_{50}	g_{51}	g_{52}	g_{53}	g_{54}	g_{55}	h_{66}	h_{76}	h_{86}	h_{96}	$h_{10,6}$	$h_{11,6}$	$h_{12,6}$
6	g_{60}	g_{61}	g_{62}	g_{63}	g_{64}	g_{65}	g_{66}	h_{77}	h_{87}	h_{97}	$h_{10,7}$	$h_{11,7}$	$h_{12,7}$
7	g_{70}	g_{71}	g_{72}	g_{73}	g_{74}	g_{75}	g_{76}	g_{77}	h_{88}	h_{98}	$h_{10,8}$	$h_{11,8}$	$h_{12,8}$
8	g_{80}	g_{81}	g_{82}	g_{83}	g_{84}	g_{85}	g_{86}	g_{87}	g_{88}	h_{99}	$h_{10,9}$	$h_{11,9}$	$h_{12,9}$
9	g_{90}	g_{91}	g_{92}	g_{93}	g_{94}	g_{95}	g_{96}	g_{97}	g_{98}	g_{99}	$h_{10,10}$	$h_{11,10}$	$h_{12,10}$
10	$g_{10,0}$	$g_{10,1}$	$g_{10,2}$	$g_{10,3}$	$g_{10,4}$	$g_{10,5}$	$g_{10,6}$	$g_{10,7}$	$g_{10,8}$	$g_{10,9}$	$g_{10,10}$	$h_{11,11}$	$h_{12,11}$
11	$g_{11,0}$	$g_{11,1}$	$g_{11,2}$	$g_{11,3}$	$g_{11,4}$	$g_{11,5}$	$g_{11,6}$	$g_{11,7}$	$g_{11,8}$	$g_{11,9}$	$g_{11,10}$	$g_{11,11}$	$h_{12,12}$
12	$g_{12,0}$	$g_{12,1}$	$g_{12,2}$	$g_{12,3}$	$g_{12,4}$	$g_{12,5}$	$g_{12,6}$	$g_{12,7}$	$g_{12,8}$	$g_{12,9}$	$g_{12,10}$	$g_{12,11}$	$g_{12,12}$

Table 2. Arrangement of Secular Variation Coefficients in Array $\dot{C}_{nm}$

n\m	0	1	2	3	4	5	6	7	8	9	10	11	12
0	$\dot{g}_{00}$	$\dot{h}_{11}$	$\dot{h}_{21}$	$\dot{h}_{31}$	$\dot{h}_{41}$	$\dot{h}_{51}$	$\dot{h}_{61}$	$\dot{h}_{71}$	$\dot{h}_{81}$	$\dot{h}_{91}$	$\dot{h}_{10,1}$	$\dot{h}_{11,1}$	$\dot{h}_{12,1}$
1	$\dot{g}_{10}$	$\dot{g}_{11}$	$\dot{h}_{22}$	$\dot{h}_{32}$	$\dot{h}_{42}$	$\dot{h}_{52}$	$\dot{h}_{62}$	$\dot{h}_{72}$	$\dot{h}_{82}$	$\dot{h}_{92}$	$\dot{h}_{10,2}$	$\dot{h}_{11,2}$	$\dot{h}_{12,2}$
2	$\dot{g}_{20}$	$\dot{g}_{21}$	$\dot{g}_{22}$	$\dot{h}_{33}$	$\dot{h}_{43}$	$\dot{h}_{53}$	$\dot{h}_{63}$	$\dot{h}_{73}$	$\dot{h}_{83}$	$\dot{h}_{93}$	$\dot{h}_{10,3}$	$\dot{h}_{11,3}$	$\dot{h}_{12,3}$
3	$\dot{g}_{30}$	$\dot{g}_{31}$	$\dot{g}_{32}$	$\dot{g}_{33}$	$\dot{h}_{44}$	$\dot{h}_{54}$	$\dot{h}_{64}$	$\dot{h}_{74}$	$\dot{h}_{84}$	$\dot{h}_{94}$	$\dot{h}_{10,4}$	$\dot{h}_{11,4}$	$\dot{h}_{12,4}$
4	$\dot{g}_{40}$	$\dot{g}_{41}$	$\dot{g}_{42}$	$\dot{g}_{43}$	$\dot{g}_{44}$	$\dot{h}_{55}$	$\dot{h}_{65}$	$\dot{h}_{75}$	$\dot{h}_{85}$	$\dot{h}_{95}$	$\dot{h}_{10,5}$	$\dot{h}_{11,5}$	$\dot{h}_{12,5}$
5	$\dot{g}_{50}$	$\dot{g}_{51}$	$\dot{g}_{52}$	$\dot{g}_{53}$	$\dot{g}_{54}$	$\dot{g}_{55}$	$\dot{h}_{66}$	$\dot{h}_{76}$	$\dot{h}_{86}$	$\dot{h}_{96}$	$\dot{h}_{10,6}$	$\dot{h}_{11,6}$	$\dot{h}_{12,6}$
6	$\dot{g}_{60}$	$\dot{g}_{61}$	$\dot{g}_{62}$	$\dot{g}_{63}$	$\dot{g}_{64}$	$\dot{g}_{65}$	$\dot{g}_{66}$	$\dot{h}_{77}$	$\dot{h}_{87}$	$\dot{h}_{97}$	$\dot{h}_{10,7}$	$\dot{h}_{11,7}$	$\dot{h}_{12,7}$
7	$\dot{g}_{70}$	$\dot{g}_{71}$	$\dot{g}_{72}$	$\dot{g}_{73}$	$\dot{g}_{74}$	$\dot{g}_{75}$	$\dot{g}_{76}$	$\dot{g}_{77}$	$\dot{h}_{88}$	$\dot{h}_{98}$	$\dot{h}_{10,8}$	$\dot{h}_{11,8}$	$\dot{h}_{12,8}$
8	$\dot{g}_{80}$	$\dot{g}_{81}$	$\dot{g}_{82}$	$\dot{g}_{83}$	$\dot{g}_{84}$	$\dot{g}_{85}$	$\dot{g}_{86}$	$\dot{g}_{87}$	$\dot{g}_{88}$	$\dot{h}_{99}$	$\dot{h}_{10,9}$	$\dot{h}_{11,9}$	$\dot{h}_{12,9}$
9	$\dot{g}_{90}$	$\dot{g}_{91}$	$\dot{g}_{92}$	$\dot{g}_{93}$	$\dot{g}_{94}$	$\dot{g}_{95}$	$\dot{g}_{96}$	$\dot{g}_{97}$	$\dot{g}_{98}$	$\dot{g}_{99}$	$\dot{h}_{10,10}$	$\dot{h}_{11,10}$	$\dot{h}_{12,10}$
10	$\dot{g}_{10,0}$	$\dot{g}_{10,1}$	$\dot{g}_{10,2}$	$\dot{g}_{10,3}$	$\dot{g}_{10,4}$	$\dot{g}_{10,5}$	$\dot{g}_{10,6}$	$\dot{g}_{10,7}$	$\dot{g}_{10,8}$	$\dot{g}_{10,9}$	$\dot{g}_{10,10}$	$\dot{h}_{11,11}$	$\dot{h}_{12,11}$
11	$\dot{g}_{11,0}$	$\dot{g}_{11,1}$	$\dot{g}_{11,2}$	$\dot{g}_{11,3}$	$\dot{g}_{11,4}$	$\dot{g}_{11,5}$	$\dot{g}_{11,6}$	$\dot{g}_{11,7}$	$\dot{g}_{11,8}$	$\dot{g}_{11,9}$	$\dot{g}_{11,10}$	$\dot{g}_{11,11}$	$\dot{h}_{12,12}$
12	$\dot{g}_{12,0}$	$\dot{g}_{12,1}$	$\dot{g}_{12,2}$	$\dot{g}_{12,3}$	$\dot{g}_{12,4}$	$\dot{g}_{12,5}$	$\dot{g}_{12,6}$	$\dot{g}_{12,7}$	$\dot{g}_{12,8}$	$\dot{g}_{12,9}$	$\dot{g}_{12,10}$	$\dot{g}_{12,11}$	$\dot{g}_{12,12}$

The numerical values of the Gauss coefficients at the base epoch and their corresponding predictive annual rates of change for the WMM-95 geomagnetic model are listed in table 3. These numerical values are inserted into arrays C and CD through data statements in the GEOMAG algorithm. Replacing the Gauss coefficients in these data statements and the date of their base epoch are the only changes that need to be made to update the algorithm from an older model to the new model. In all other respects the GEOMAG routine remains unaltered. Other versions of the GEOMAG routine exist for which the coefficients can be read in from an external file. Then, only the external coefficient data file needs to be updated, while the algorithm remains unchanged, except for comment statements that may be revised.

Important parameters in the GEOMAG routine and their mathematical correspondences are:

A	~	$a = 6378.137\ km$
B	~	$b = 6356.7523142\ km$
RE	~	$R_E = 6371.2\ km$
TIME	~	t
EPOCH	~	T_{Epoch}
DT	~	$t\text{-}T_{Epoch}$
ALT	~	h
SNORM(N,M)	~	$S^{n\,m}$
K(N,M)	~	$\kappa^{n\,m}$
GLAT	~	λ
GLON	~	φ
SP(M)	~	$sin(m\varphi)$
CP(M)	~	$cos(m\varphi)$
ST	~	$sin(\theta)$
CT	~	$cos(\theta)$
CA	~	$cos(\alpha)$
SA	~	$sin(\alpha)$
BR	~	B_r
BT	~	B_θ
BP	~	B_φ
BX	~	B_X
BY	~	B_Y
BZ	~	B_Z
DEC	~	B_D
DIP	~	B_I
TI	~	B_F
MAXDEG	~	N
MAXORD	~	$M = N$
P(N,M)	~	$P^{n\,m}(\theta)$
DP(N,M)	~	$\frac{dP^{n\,m}(\theta)}{d\theta}$
TC	~	$C + (t - T_{Epoch})\dot{C}$
CD	~	$\dot{C}$
Q2	~	Q^2

Table 3. WMM-95 Model Coefficients

n	m	g_n^m	h_n^m	$\dot{g}_n^m$	$\dot{h}_n^m$
1	0	-29,682.1	0.0	17.6	0.0
1	1	-1,782.2	5,315.6	13.2	-18.0
2	0	-2,194.7	0.0	-13.7	0.0
2	1	3,078.6	-2,359.1	4.0	-14.6
2	2	1,685.7	-418.6	-0.3	-7.2
3	0	1,318.8	0.0	0.8	0.0
3	1	-2,273.6	-261.1	-6.6	4.0
3	2	1,246.9	301.0	-0.5	2.2
3	3	766.3	-416.5	-8.5	-12.6
4	0	940.0	0.0	1.2	0.0
4	1	782.9	259.4	1.1	1.3
4	2	290.9	-230.9	-6.8	1.0
4	3	-418.9	99.8	0.3	2.5
4	4	113.8	-306.1	-4.5	-1.2
5	0	-209.5	0.0	0.9	0.0
5	1	354.0	43.7	0.5	0.5
5	2	238.2	157.6	-1.4	1.5
5	3	-122.1	-150.1	-1.7	0.6
5	4	-162.8	-59.2	0.0	1.7
5	5	-23.3	104.4	2.1	0.6
6	0	68.5	0.0	0.4	0.0
6	1	65.6	-15.2	-0.3	0.7
6	2	64.1	74.3	0.3	-1.5
6	3	-169.1	69.4	2.1	-0.5
6	4	-0.5	-55.3	0.0	-0.7
6	5	16.5	3.0	-0.4	1.1
6	6	-91.0	33.3	-0.4	2.6
7	0	78.0	0.0	-0.3	0.0
7	1	-68.1	-76.1	-1.1	0.3
7	2	0.1	-24.5	-0.5	0.0

Table 3. WMM-95 Model Coefficients (Con.)

n	m	g_n^m	h_n^m	$\dot{g}_n^m$	$\dot{h}_n^m$
7	3	29.6	1.6	0.5	0.7
7	4	6.0	20.0	1.3	-0.6
7	5	8.7	16.5	0.1	0.1
7	6	9.2	-23.6	0.0	-0.6
7	7	-2.4	-6.8	-0.9	-0.4
8	0	24.7	0.0	0.1	0.0
8	1	3.4	14.9	0.0	0.4
8	2	-1.5	-19.5	0.4	-0.3
8	3	-9.6	6.3	0.3	0.1
8	4	-16.5	-20.4	-1.3	0.8
8	5	2.6	12.2	0.5	-0.1
8	6	3.6	7.0	0.4	-1.3
8	7	-4.9	-19.0	-0.9	-0.9
8	8	-8.5	-8.8	0.1	-1.1
9	0	2.9	0.0	0.0	0.0
9	1	7.5	-19.8	0.0	0.0
9	2	0.4	14.6	0.0	0.0
9	3	-10.3	10.9	0.0	0.0
9	4	9.7	-7.5	0.0	0.0
9	5	-2.3	-6.8	0.0	0.0
9	6	-2.4	9.3	0.0	0.0
9	7	6.8	7.7	0.0	0.0
9	8	-0.5	-8.1	0.0	0.0
9	9	-6.5	2.6	0.0	0.0
10	0	-2.9	0.0	0.0	0.0
10	1	-3.3	3.2	0.0	0.0
10	2	2.8	1.7	0.0	0.0
10	3	-4.3	2.9	0.0	0.0
10	4	-3.1	5.6	0.0	0.0
10	5	2.4	-3.4	0.0	0.0

Table 3. WMM-95 Model Coefficients (Con.)

n	m	g_n^m	h_n^m	$\dot{g}_n^m$	$\dot{h}_n^m$
10	6	2.8	-0.7	0.0	0.0
10	7	0.7	-2.9	0.0	0.0
10	8	4.1	2.3	0.0	0.0
10	9	3.6	-1.6	0.0	0.0
10	10	0.6	-6.6	0.0	0.0
11	0	1.7	0.0	0.0	0.0
11	1	-1.6	0.3	0.0	0.0
11	2	-3.6	1.0	0.0	0.0
11	3	1.2	-3.6	0.0	0.0
11	4	-0.6	-1.4	0.0	0.0
11	5	0.1	1.9	0.0	0.0
11	6	-0.7	0.2	0.0	0.0
11	7	-0.8	-1.3	0.0	0.0
11	8	1.3	-2.4	0.0	0.0
11	9	-0.3	-0.6	0.0	0.0
11	10	2.2	-2.2	0.0	0.0
11	11	4.2	1.3	0.0	0.0
12	0	-1.8	0.0	0.0	0.0
12	1	0.9	0.3	0.0	0.0
12	2	-0.1	1.4	0.0	0.0
12	3	-0.5	0.8	0.0	0.0
12	4	0.8	-3.0	0.0	0.0
12	5	0.2	0.7	0.0	0.0
12	6	0.5	0.5	0.0	0.0
12	7	0.4	-0.8	0.0	0.0
12	8	-0.4	0.6	0.0	0.0
12	9	0.3	0.1	0.0	0.0
12	10	0.2	-1.3	0.0	0.0
12	11	0.4	-0.4	0.0	0.0
12	12	0.6	0.9	0.0	0.0

Note that R_E is not intended to be the mean radius of the WGS-84 ellipsoid. By international convention established by the International Association of Geomagnetism and Aeronomy (IAGA) circa 1968, it is the mean radius of a modified ellipsoid established by the International Astronomical Union (IAU) in 1966. This ellipsoid is referred to as the modified IAU-66 ellipsoid (Zmuda [1971]).

The GEOMAG algorithm is organized into two modules, each with its own entry point. The first is an *Initialization Module.* Its purpose is to compute all constants such as the recursion relation factors for the associated Legendre polynomials κ^{nm}, the Schmidt normalization factors S^{nm}, and any other parameters that do not depend on position or time. The entry point for this module is:

GEOMAG(MAXDEG)

The parameter MAXDEG determines the maximum degree and order of the magnetic model to be used in the computations. Normally, MAXDEG=12, which is the maximum degree and order of the WMM series of geomagnetic models. In order to reduce computation time, MAXDEG may be set to a number less than 12 (e.g., 8 or 10). However, the accuracy of the computed magnetic parameters is correspondingly reduced. MAXDEG must be set in the calling program.

The second module is the *Processing Module*, which has the following entry point:

GEOMG1(ALT,GLAT,GLON,TIME,DEC,DIP,TI,GV)

The purpose of this module is to compute the magnetic *Declination*, *Inclination*, *Total Intensity*, and the *Grid Variation* at each *geodetic* position and time supplied to it. The units of the parameters in the argument list of the GEOMG1 entry point are as follows:

ALT	~	kilometers	(e.g., 5.314)	(IN)
GLAT	~	degrees	(e.g., 33.716)	(IN)
GLON	~	degrees	(e.g., -163.315)	(IN)
TIME	~	years	(e.g., 1997.427)	(IN)
DEC	~	degrees	(e.g., -121.734)	(OUT)
DIP	~	degrees	(e.g., 48.387)	(OUT)
TI	~	nanoTeslas	(e.g., 35781.7)	(OUT)
GV	~	degrees	(e.g., 51.768)	(OUT)

The computed magnetic field parameters are referenced to the WGS-84 ellipsoid. The last parameter, GV, is the Grid Variation which is computed only for the polar regions (i.e., above $+55^0$ latitude or below -55^0 latitude). Outside of these regions, a default value of -999.0 is dummied in. The Grid Variation is referenced to *Grid North* of a polar stereographic projection. The model is considered to be a valid representation of the Earth's core magnetic field at geodetic altitudes ranging from the *ocean bottom* to +1000 *km* for all geodetic latitudes and longitudes.

The SV computation of a geomagnetic component at a fixed time $t = \tau$ is accomplished by making two calls to the entry point GEOMG1, one at time $t_1 = \tau - 0.5$ and one at time $t_2 = \tau + 0.5$, where t is expressed in years. This yields the Declination, Inclination, and the Total Intensity at two different times spaced one year apart. Using these three magnetic components, any other magnetic component can be calculated at these same two times via eqs. (21a) through (21e) and eqs. (22a) through (22d). The SV is then determined by differencing the two MF values of a particular component. For example, the Horizontal component's SV is computed by inserting eq. (22a) into the following:

$$\dot{H}(\lambda, \varphi, h, \tau) = [H(\lambda, \varphi, h, t_2) - H(\lambda, \varphi, h, t_1)]/\Delta t \tag{27}$$

where

$$\Delta t = t_2 - t_1 = 1\,year \tag{28}$$

The FORTRAN code for the *internal version* (i.e., coefficients embedded in the algorithm as data statements) of the GEOMAG algorithm is listed in the appendix.

SECTION 2

THE 1995 EPOCH GEOMAGNETIC MODEL DERIVATION

2.0 Overview

Three major data sets were available for the 1995 epoch modeling effort. These were *scalar* magnetic data from NAVOCEANO's POGS satellite collected from January 1991 through July 1993; NAVOCEANO's Project MAGNET high-altitude ($\geq$ 15,000 ft., or $\geq$ 4.57 km) *vector-aeromagnetic* survey data collected from October 1988 through December 1993; and Geomagnetic Observatory *vector* annual-magnetic-means data collected between 1985 and 1994 and provided by many cooperating nations throughout the world. Considerable effort was expended toward both the acquisition and the reduction of these data sets in order to make them suitable for modeling purposes. The data acquisition/reduction procedures for POGS data are described by Quinn et al. (1993b), while those for Project MAGNET data are described by Coleman (1992). Those for observatory vector-annual-magnetic-means data are described by Macmillan (1994).

In addition to the usual concern of isolating the core field from the magnetic field measurements, which also contain ionospheric, magnetospheric, and crustal magnetic field contaminations, the quality of the world magnetic model generated from these data are influenced by four major factors:

a. Data age relative to the model epoch;
b. Data temporal coherence;
c. Data spatial uniformity; and
d. Data spatial density.

None of the three available data sets are ideal in all of these respects. However, the bulk of these data sets do overlap in time and are fairly recent data, being less than 5 years old.

Small POGS data subsets (i.e., having a 20- to 60-day time span) may be considered temporally coherent, uniformly distributed in space, and of sufficient spatial density for degree 12 spherical-harmonic modeling. The POGS satellite data distribution used in the 1995 epoch modeling sequence is illustrated in the Aitoff equal-area charts 1 through 42. The data shown are specially selected for geomagnetically quiet times. The data selection criteria consists of the following:

a. $Kp \leq 2^+$
b. $|Dst(\Theta)| \leq 50$ nT
c. Local Time: night-side, 7 PM to 5 AM

The *planetary K* (Kp) index is a measure of solar activity and ranges from 0 to 9 with 0 being the quietest time. The *Disturbance storm-time* (Dst) index is, at least classically, a measure of the strength of the magnetospheric *Ring current.* It is based on geomagnetic measurements made by a select group of geomagnetic observatories located near the geomagnetic equator. The Dst index is referenced to the geomagnetic equator [i.e., Dst(0)]. Its value at higher geomagnetic latitudes, Θ, has been taken to be the equatorial value provided by M. Sugiura through the National Geophysical Data Center (NGDC), *multiplied* by the cosine of the geomagnetic latitude, and is denoted as $Dst(\Theta)$. *Note that inadvertently, the POGS data files*

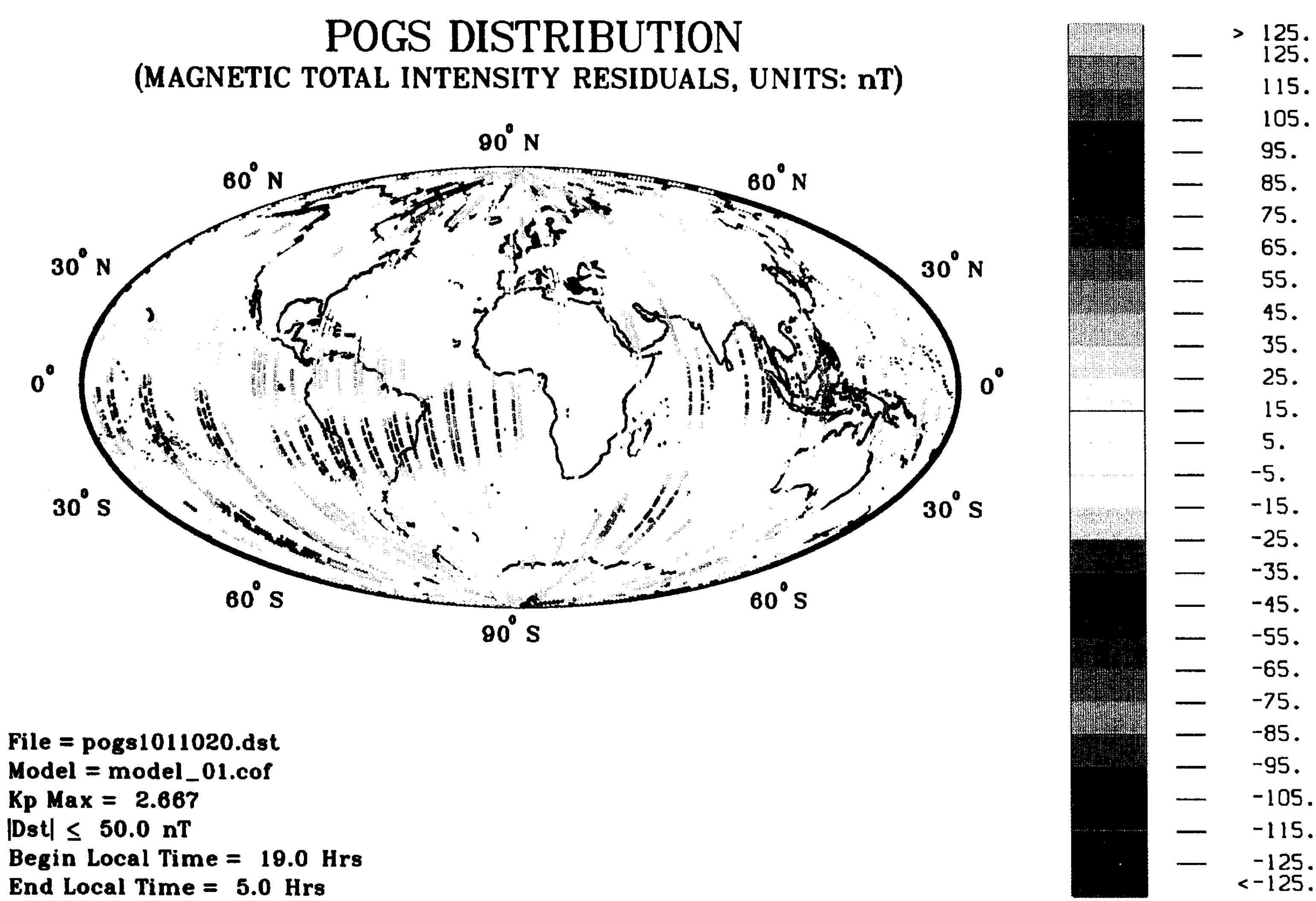


Chart 1. POGS Distribution: 1991, Days 011 - 020, **F** Component Residuals

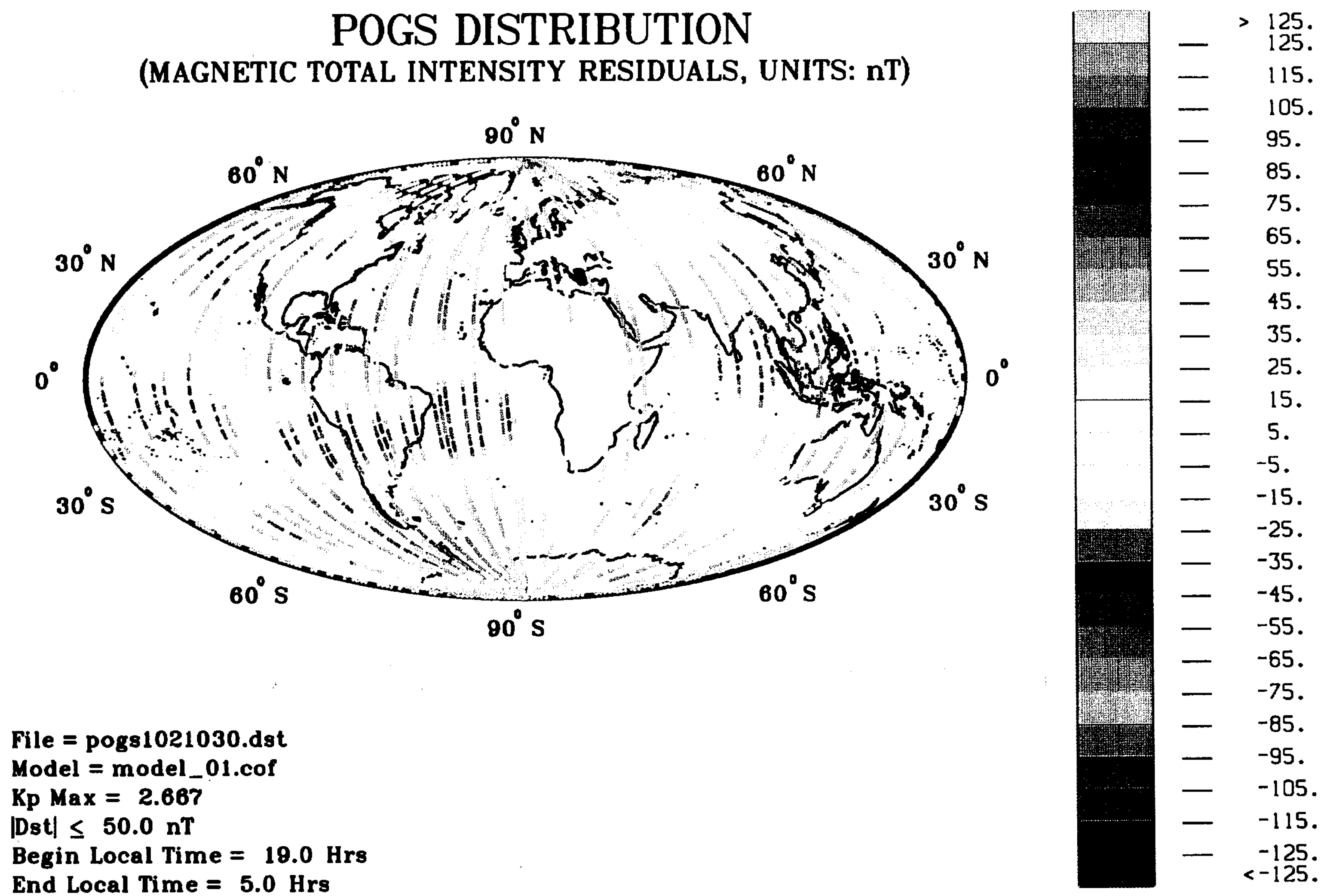


Chart 2. POGS Distribution: 1991, Days 021 - 030, **F** Component Residuals

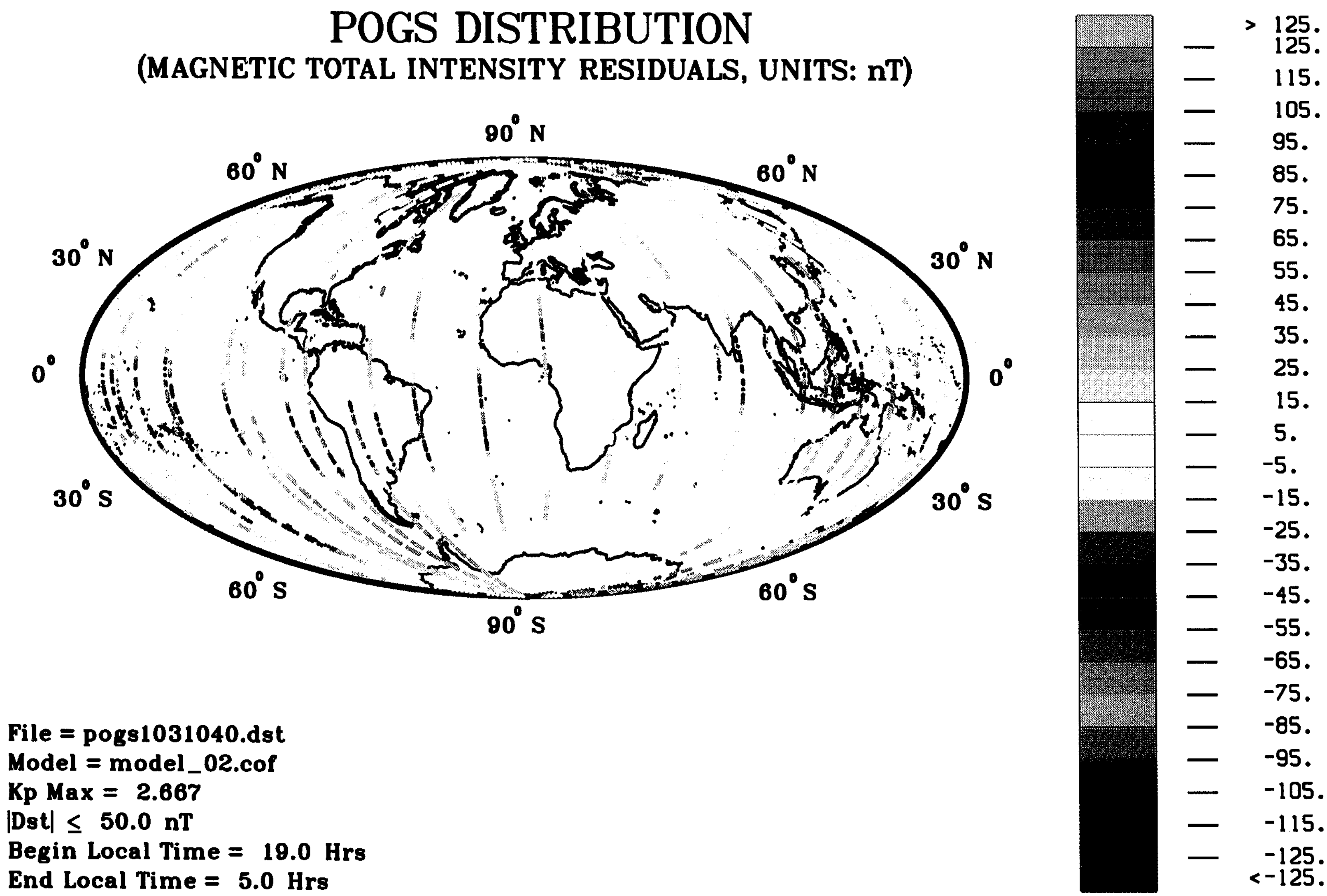


Chart 3. POGS Distribution: 1991, Days 031 - 040, **F** Component Residuals

POGS DISTRIBUTION
(MAGNETIC TOTAL INTENSITY RESIDUALS, UNITS: nT)

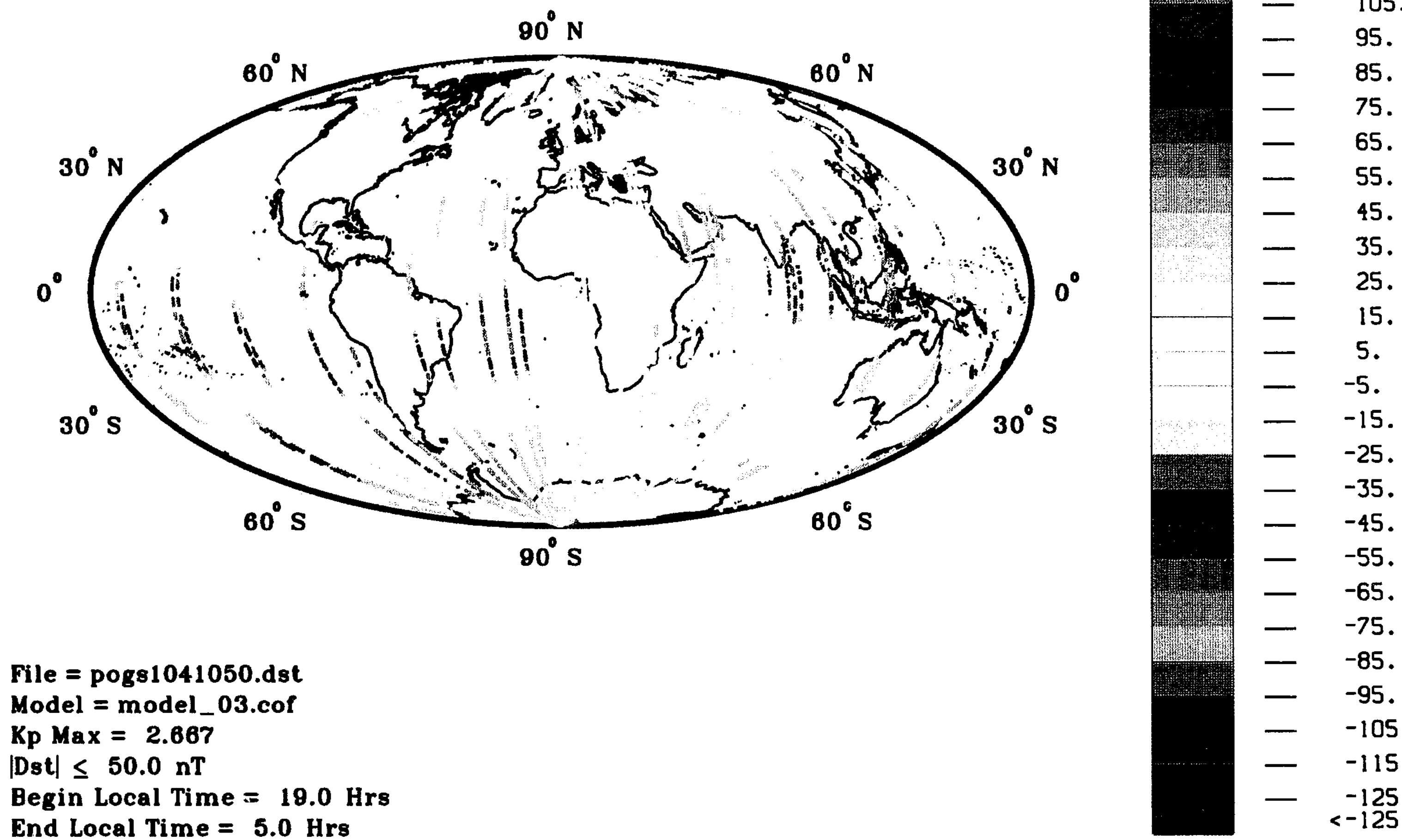
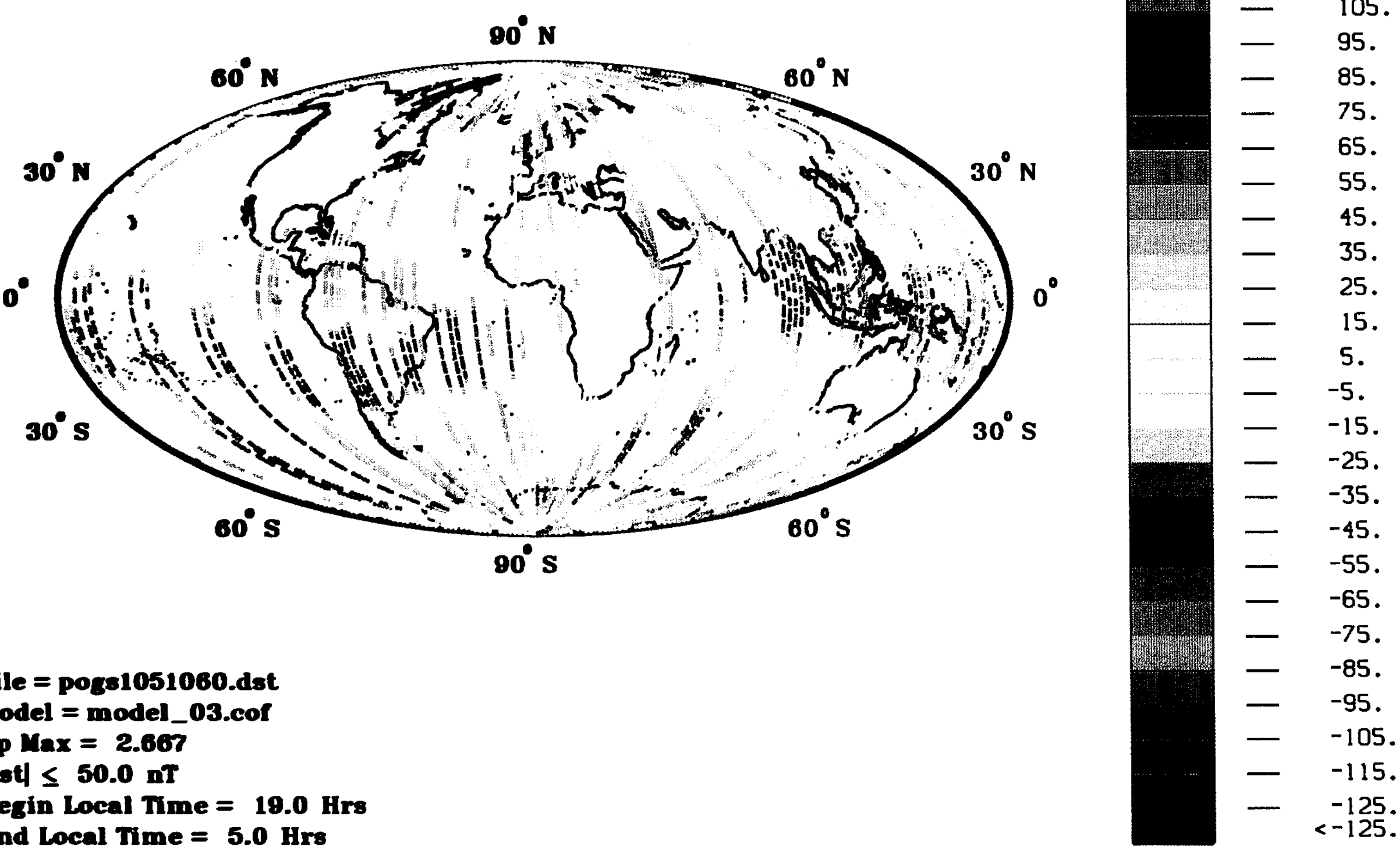


Chart 4. POGS Distribution: 1991, Days 041 - 050, F Component Residuals

POGS DISTRIBUTION
(MAGNETIC TOTAL INTENSITY RESIDUALS, UNITS: nT)



File = pogs1051060.dst
Model = model_03.cof
Kp Max = 2.667
|Dst| ≤ 50.0 nT
Begin Local Time = 19.0 Hrs
End Local Time = 5.0 Hrs

Chart 5. POGS Distribution: 1991, Days 051 - 060, F Component Residuals

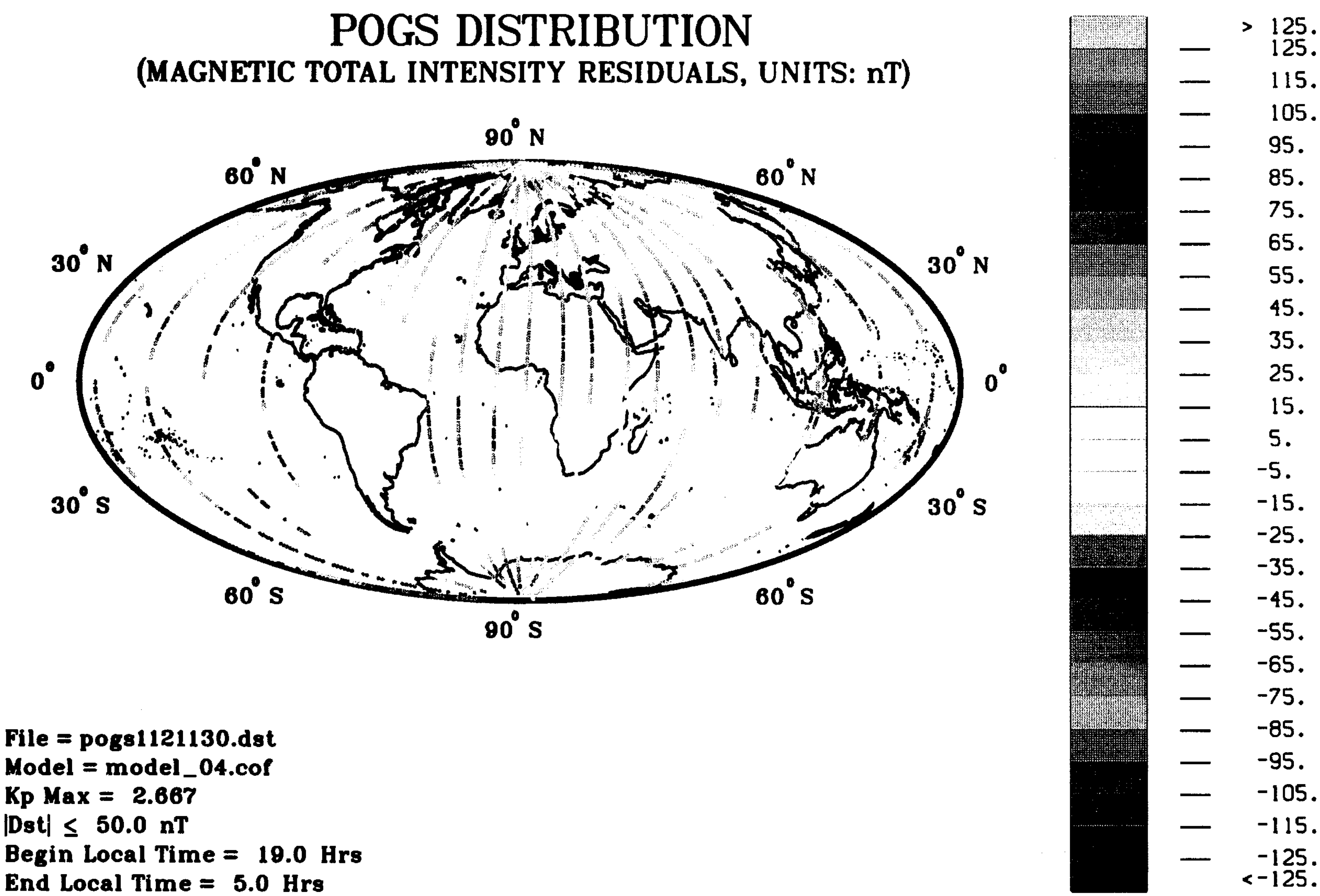


Chart 6. POGS Distribution: 1991, Days 121 - 130, F Component Residuals

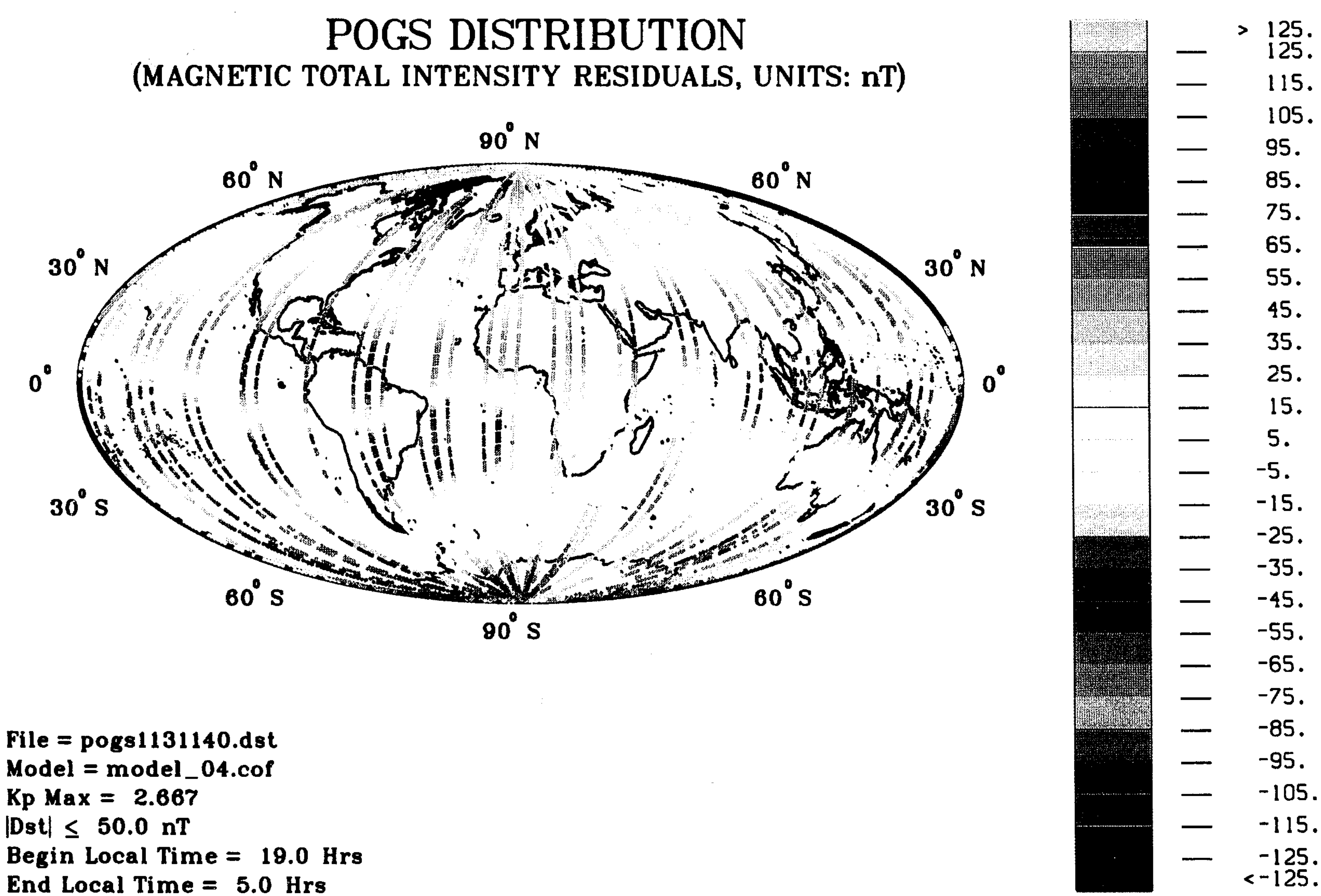


Chart 7. POGS Distribution: 1991, Days 131 - 140, **F** Component Residuals

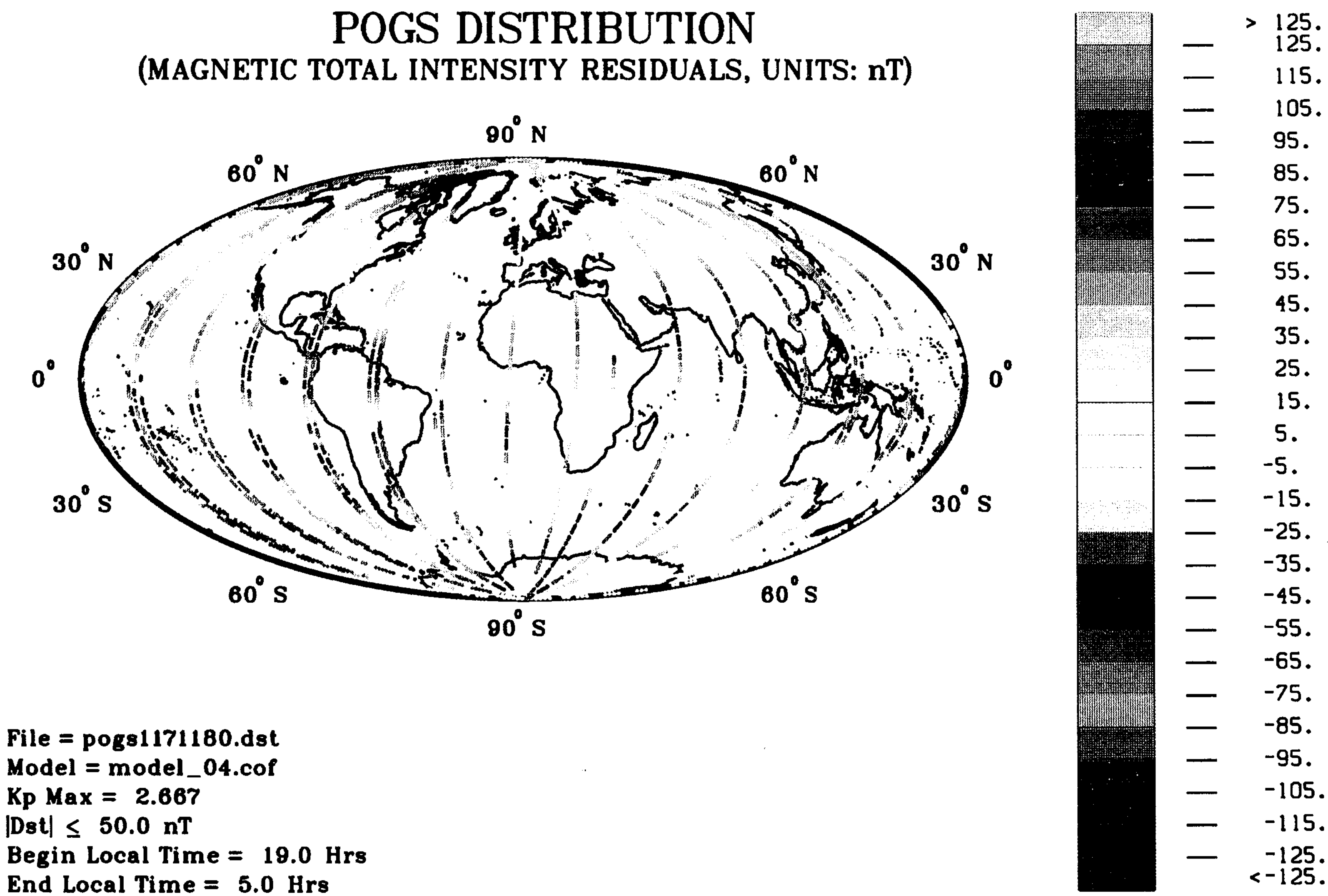


Chart 8. POGS Distribution: 1991, Days 171 - 180, **F** Component Residuals

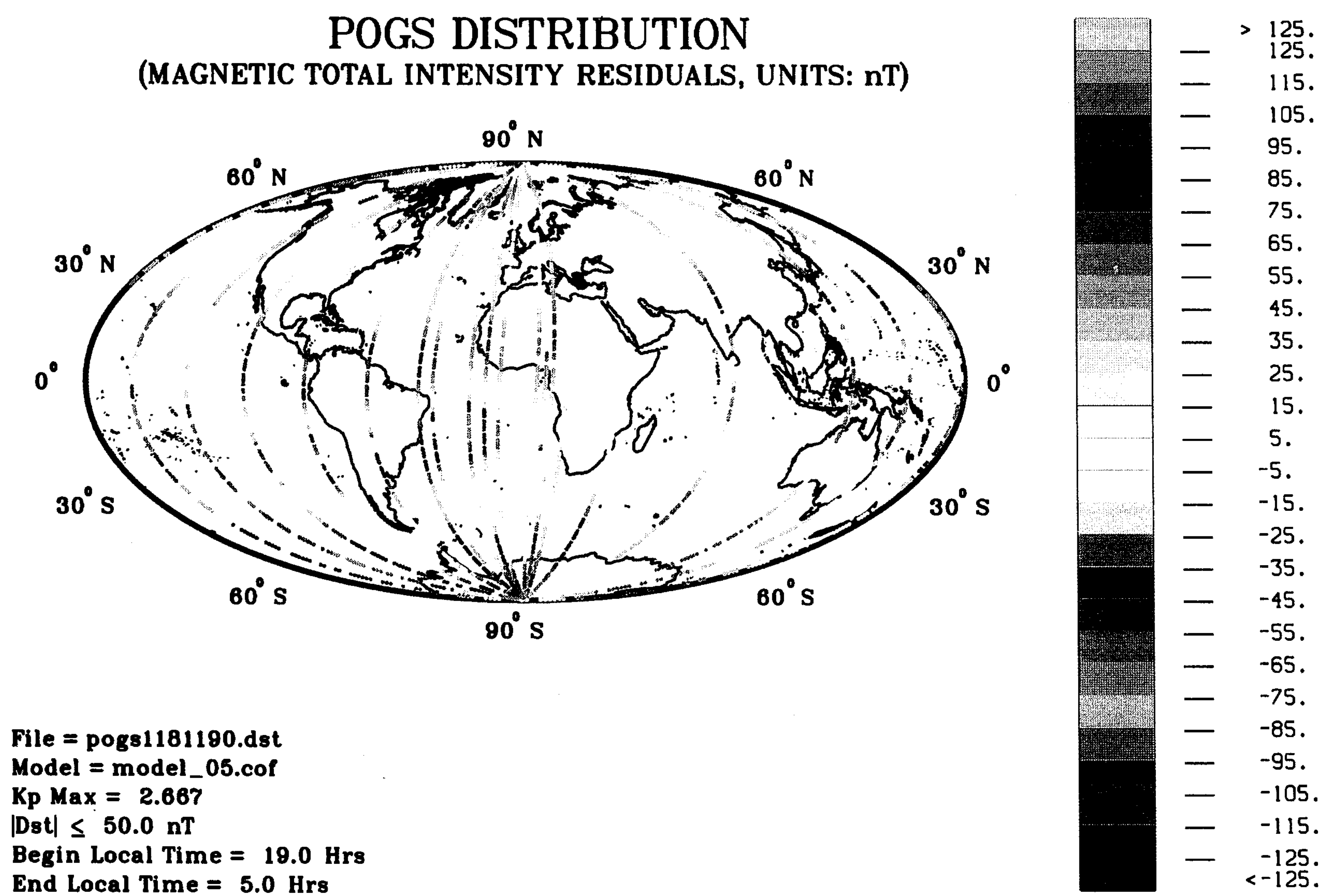


Chart 9. POGS Distribution: 1991, Days 181 - 190, F Component Residuals

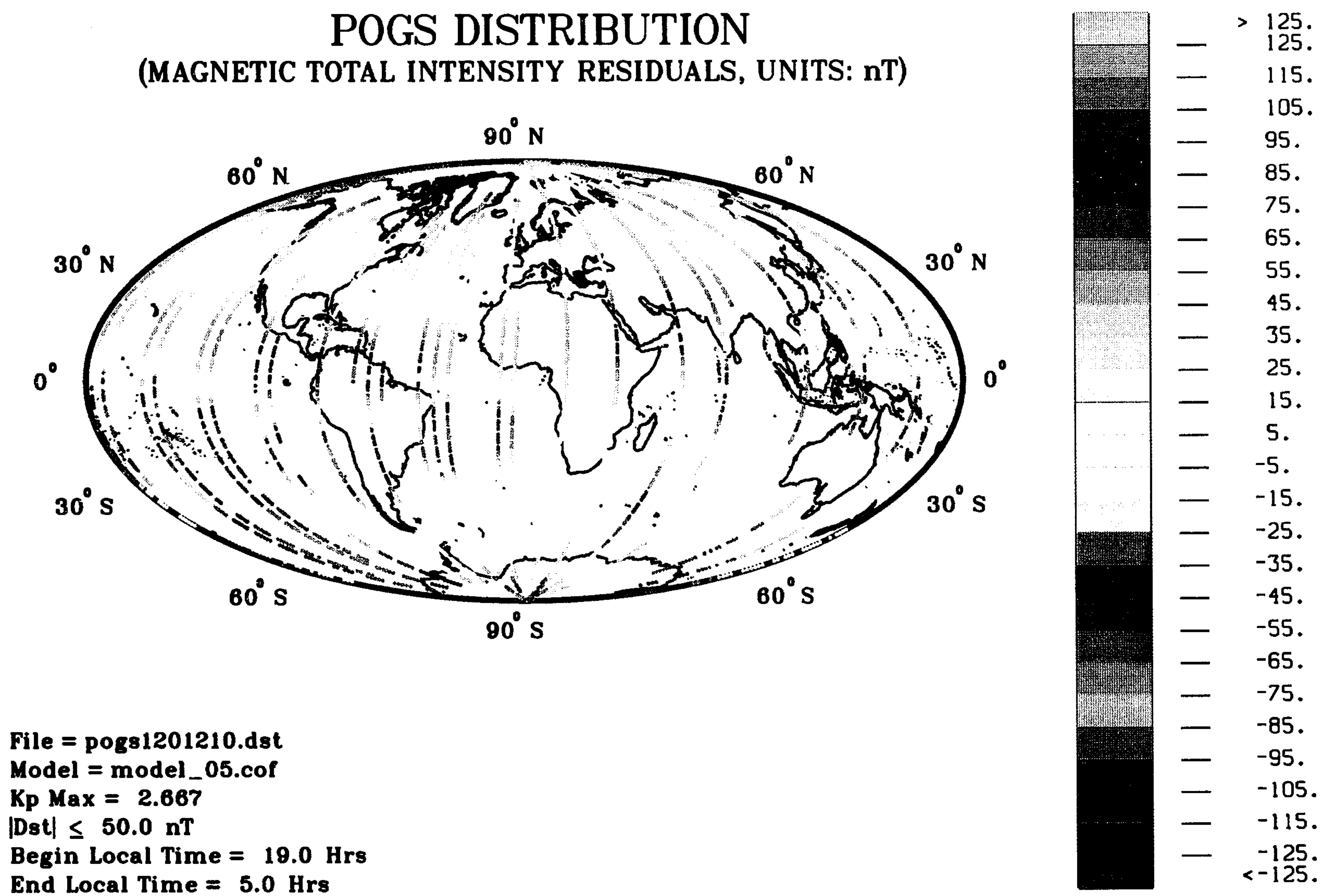


Chart 10. POGS Distribution: 1991, Days 201 - 210, F Component Residuals

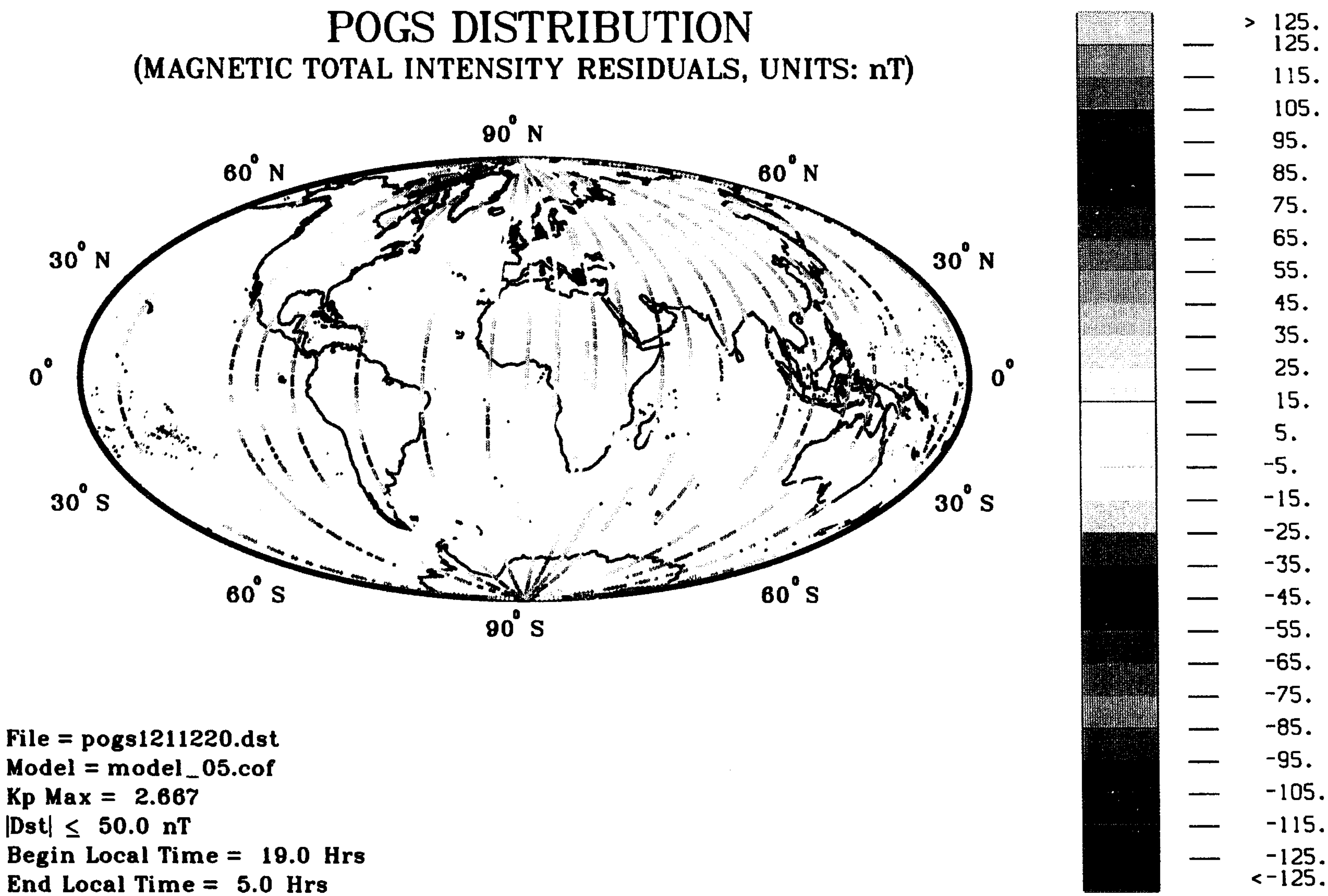


Chart 11. POGS Distribution: 1991, Days 211 - 220, **F** Component Residuals

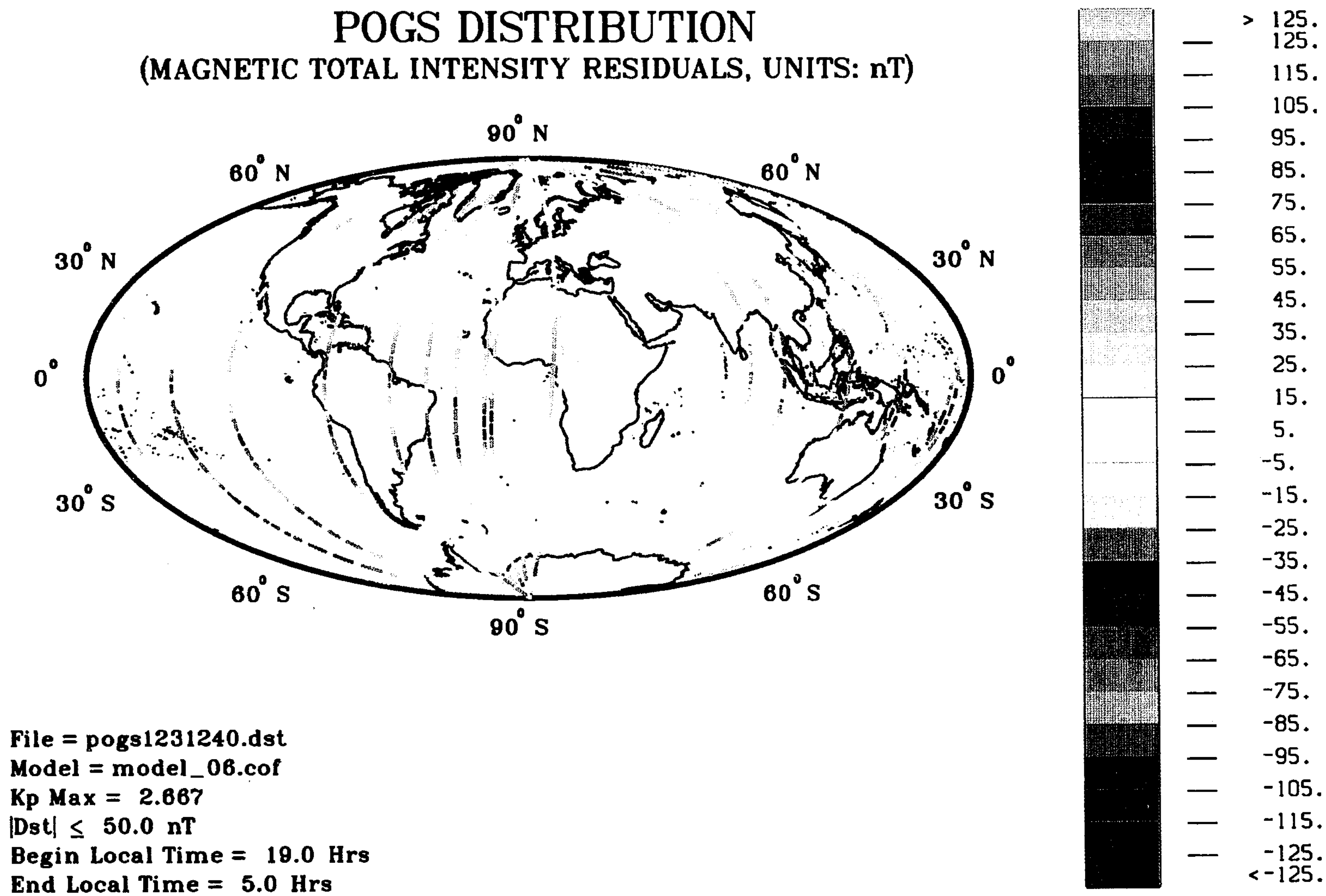


Chart 12. POGS Distribution: 1991, Days 231 - 240, **F** Component Residuals

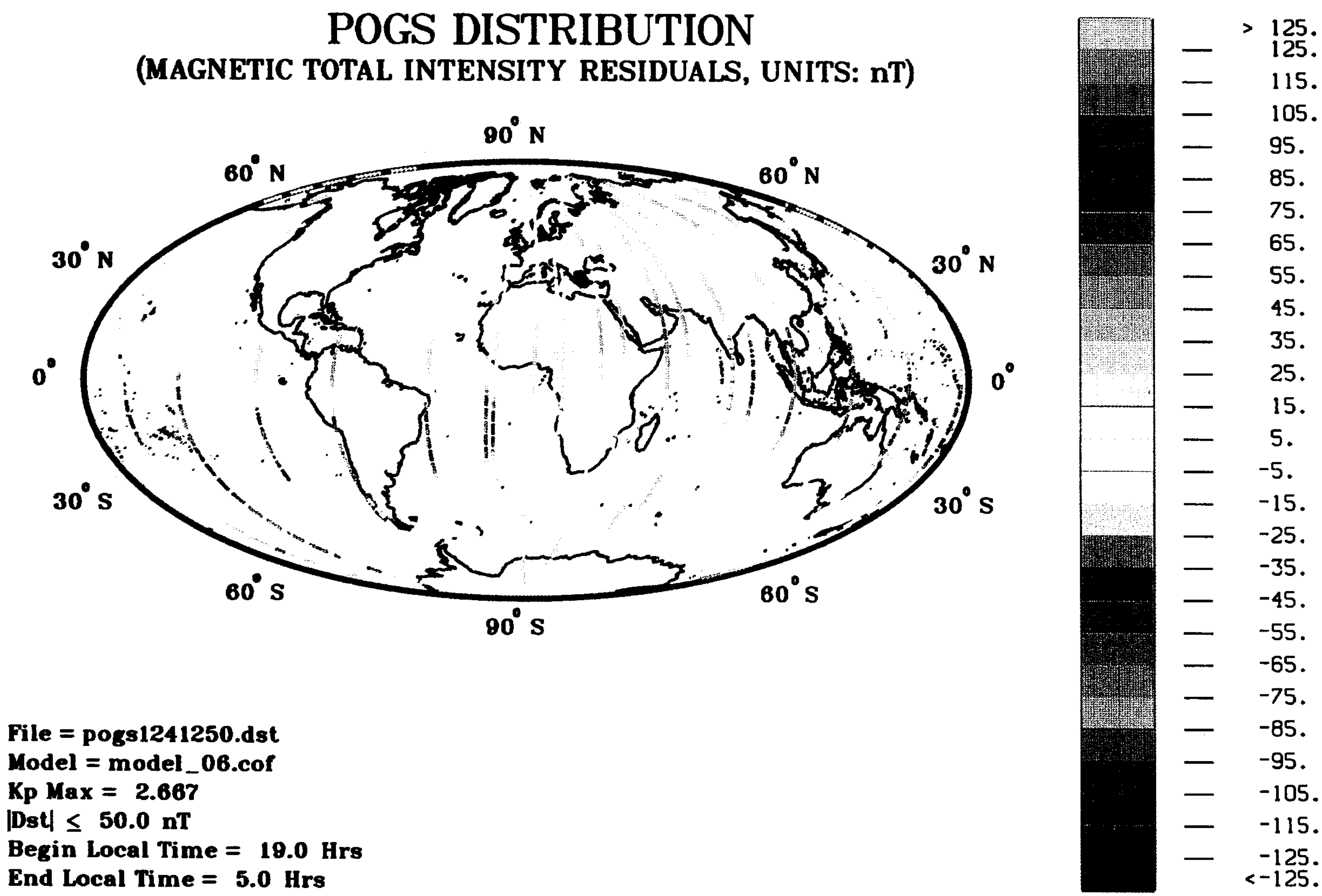


Chart 13. POGS Distribution: 1991, Days 241 - 250, F Component Residuals

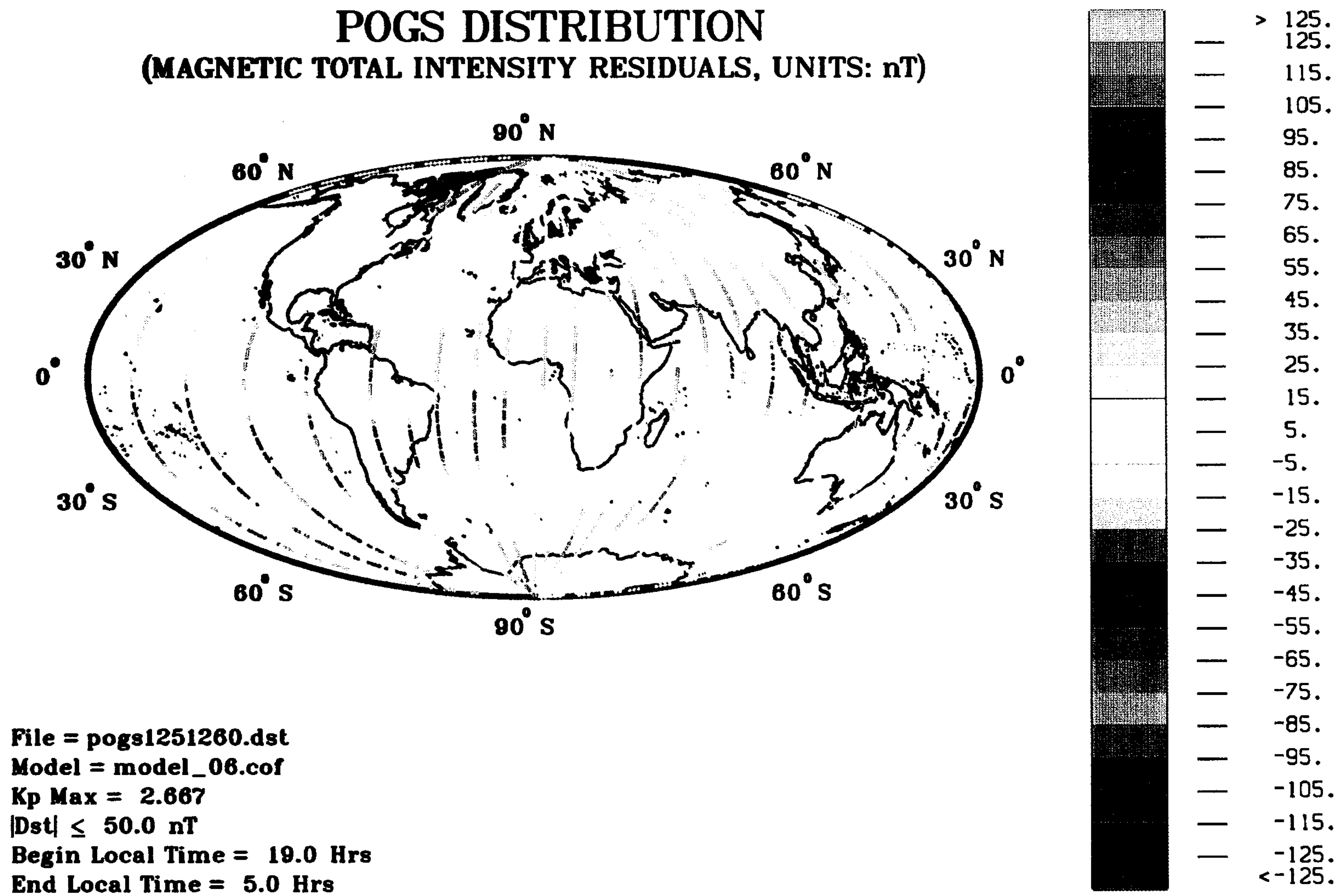


Chart 14. POGS Distribution: 1991, Days 251 - 260, F Component Residuals

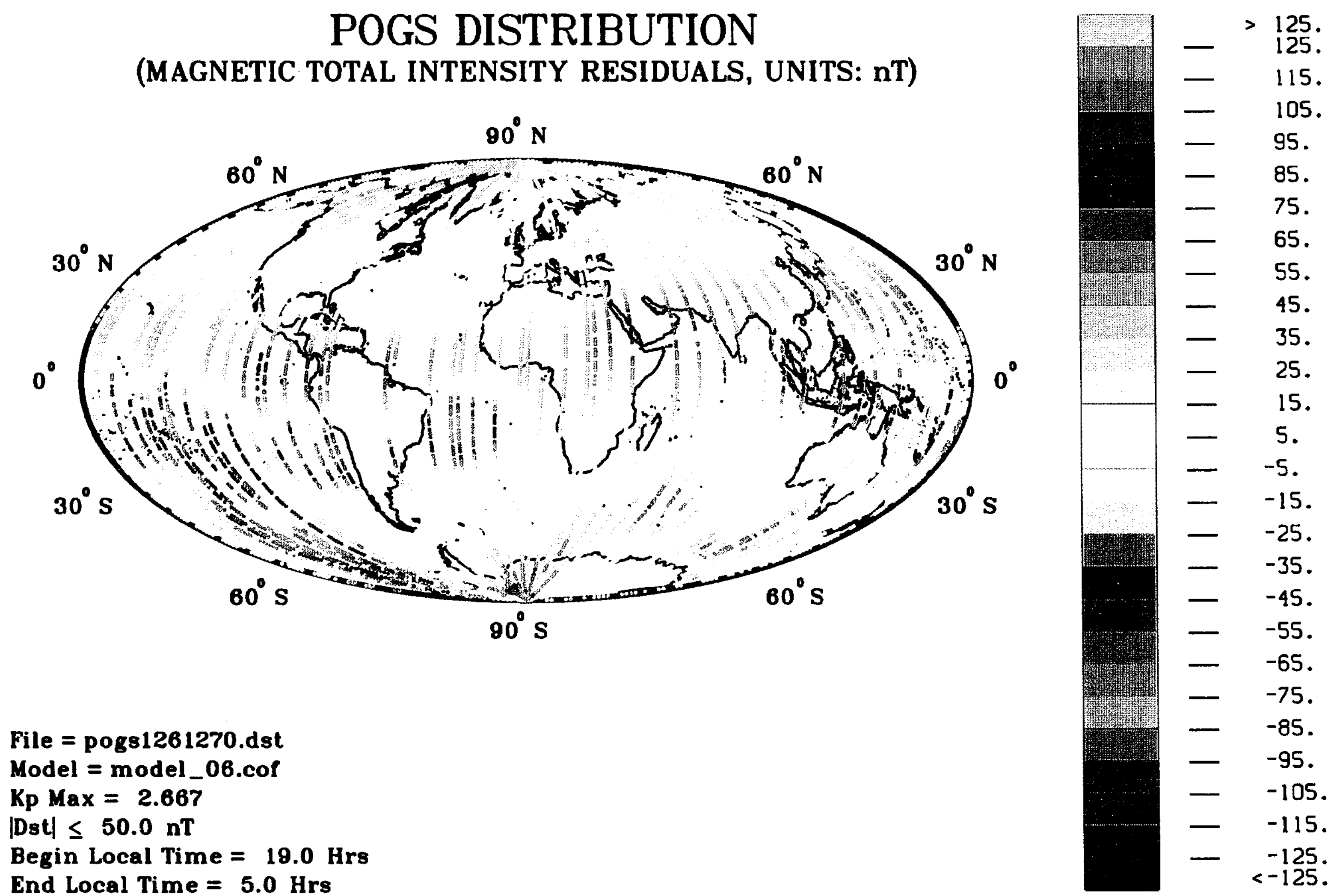


Chart 15. POGS Distribution: 1991, Days 261 - 270, **F** Component Residuals

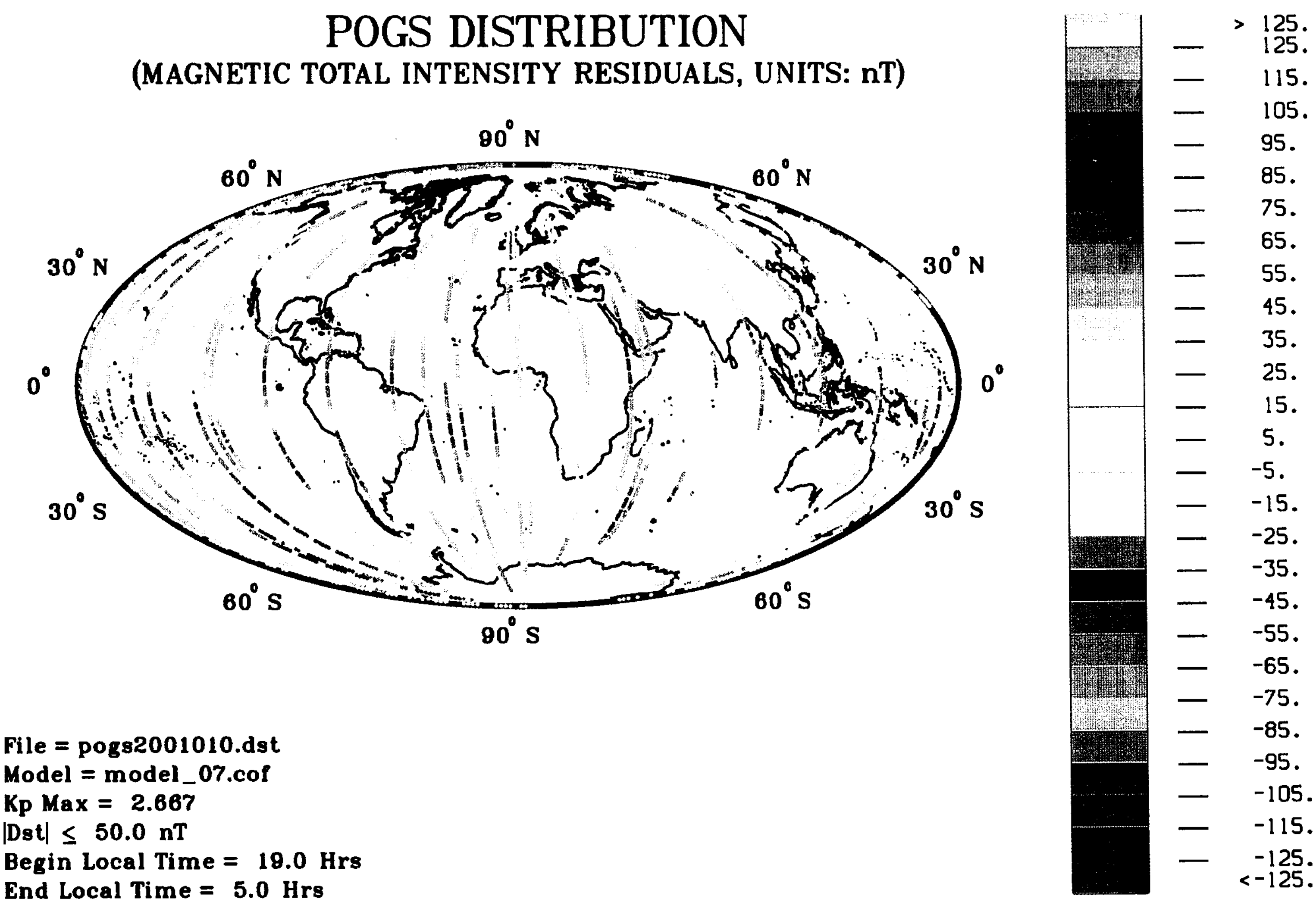


Chart 16. POGS Distribution: 1992, Days 001 - 010, **F** Component Residuals

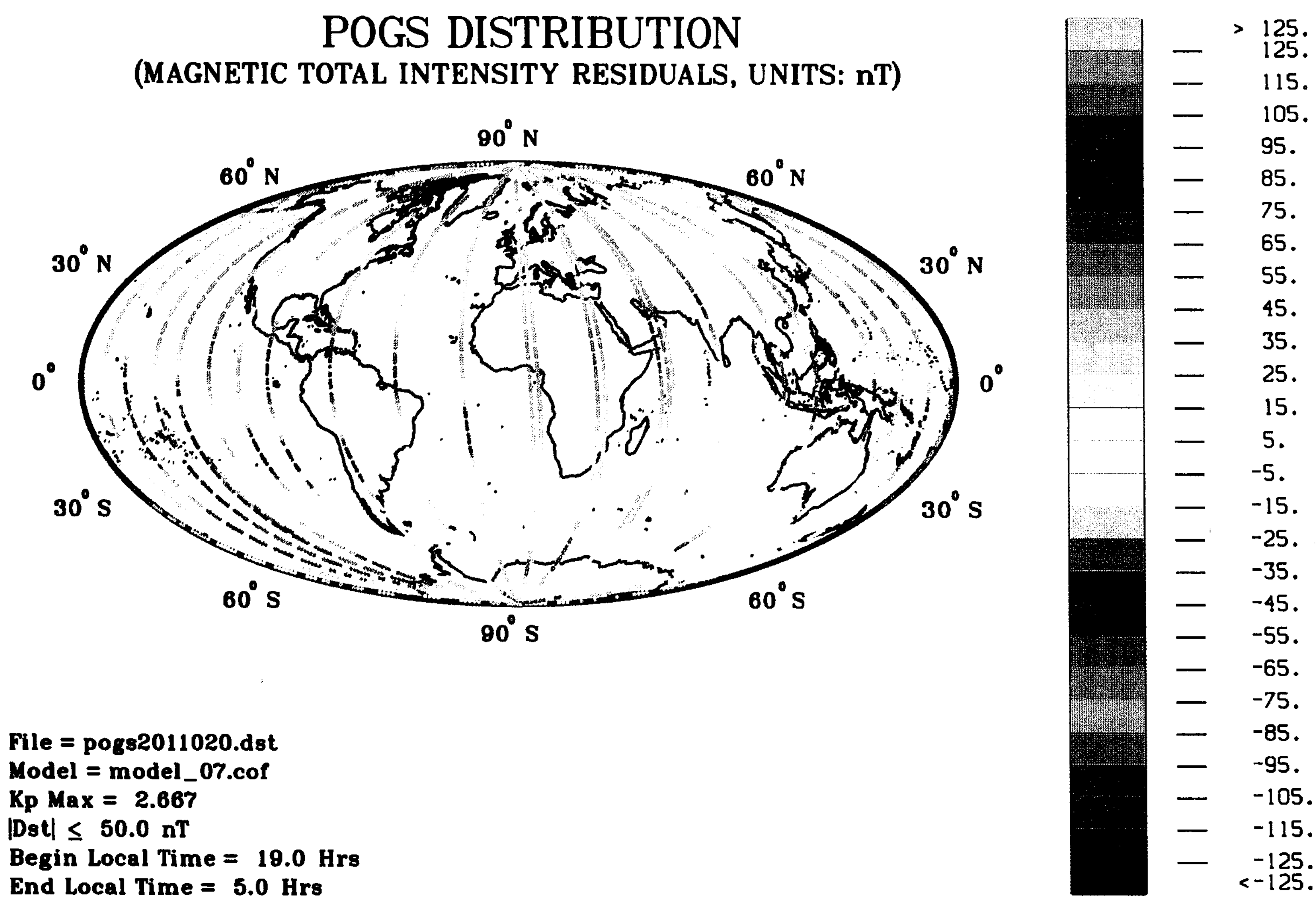


Chart 17. POGS Distribution: 1992, Days 011 - 020, F Component Residuals

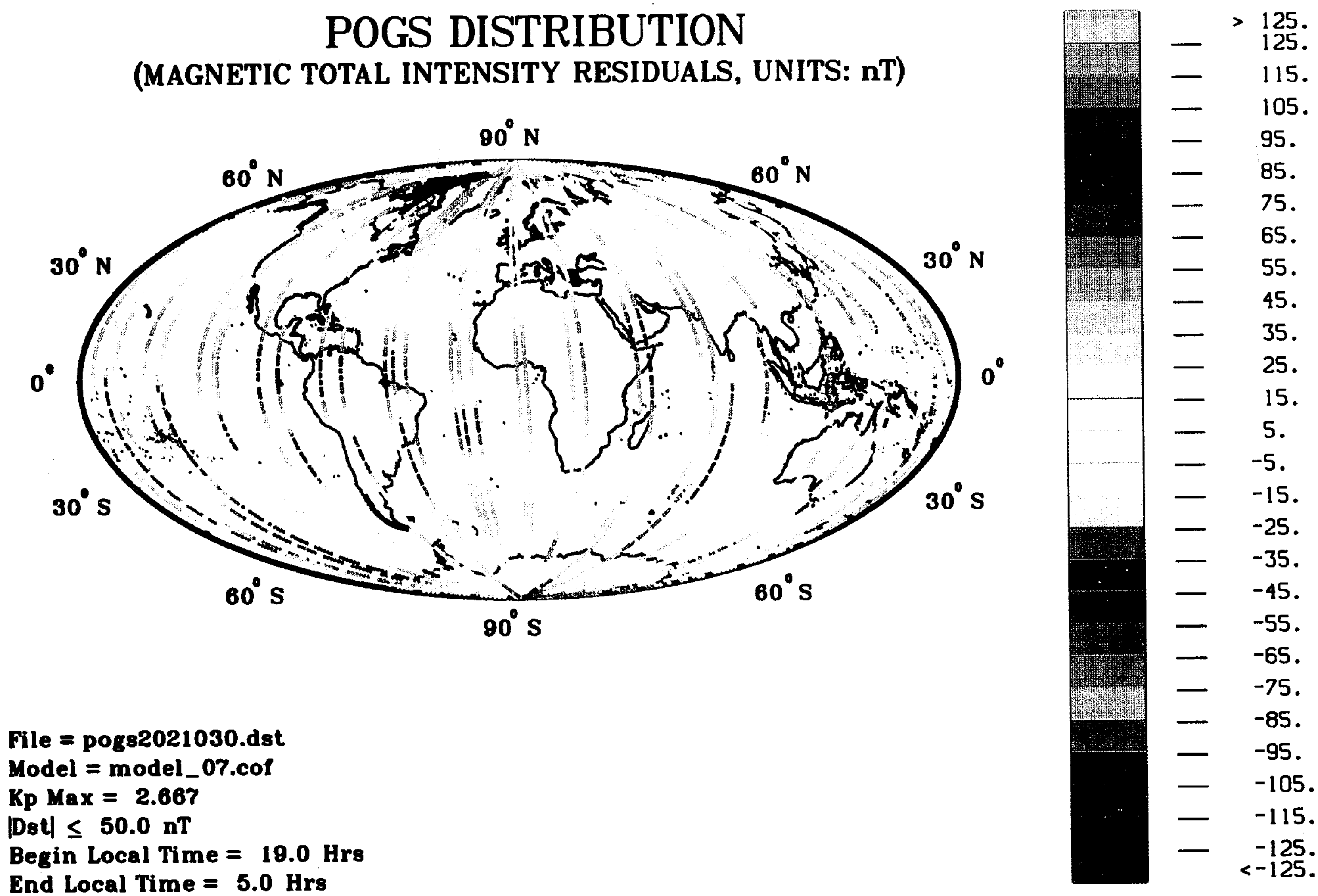


Chart 18. POGS Distribution: 1992, Days 021 - 030, **F** Component Residuals

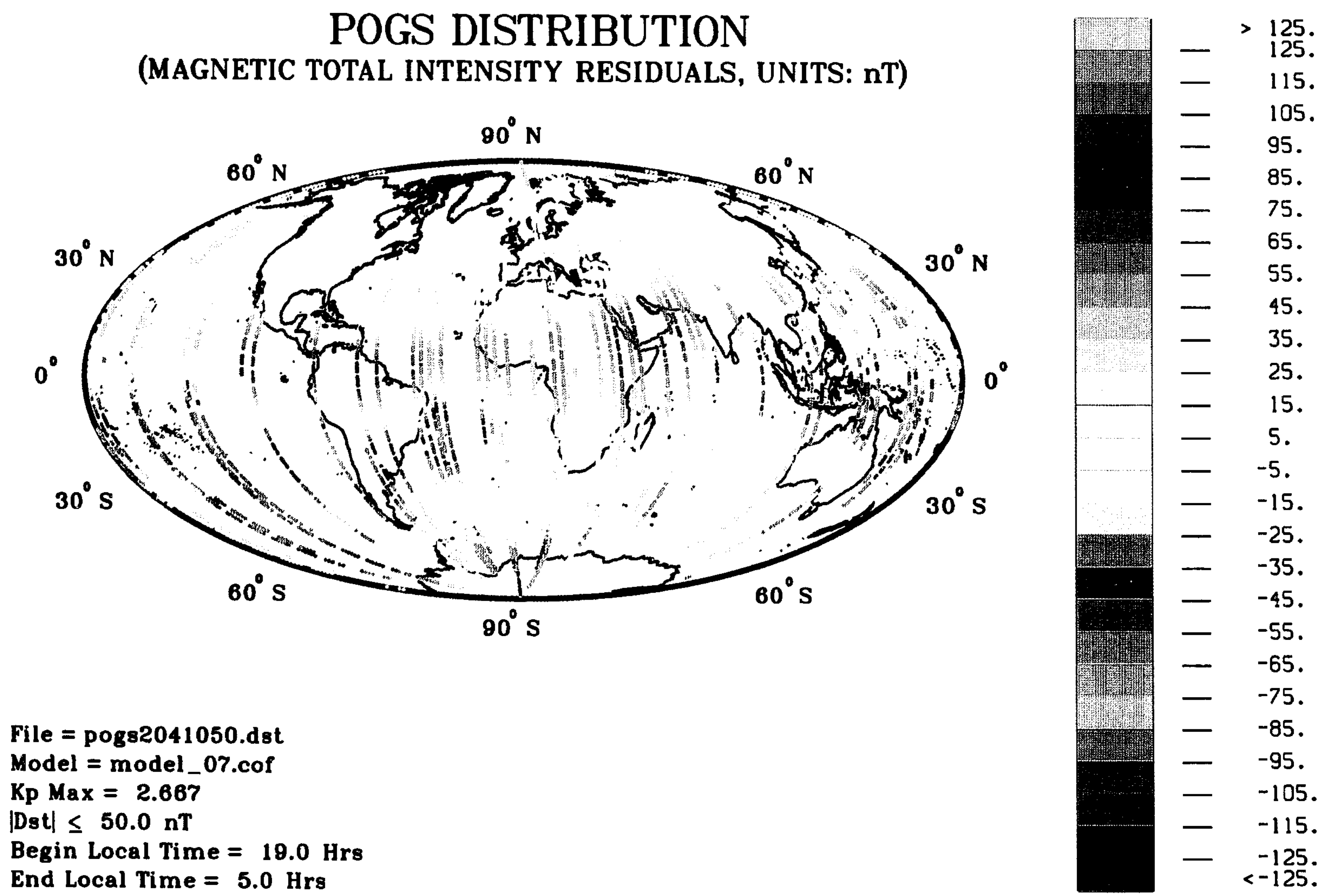
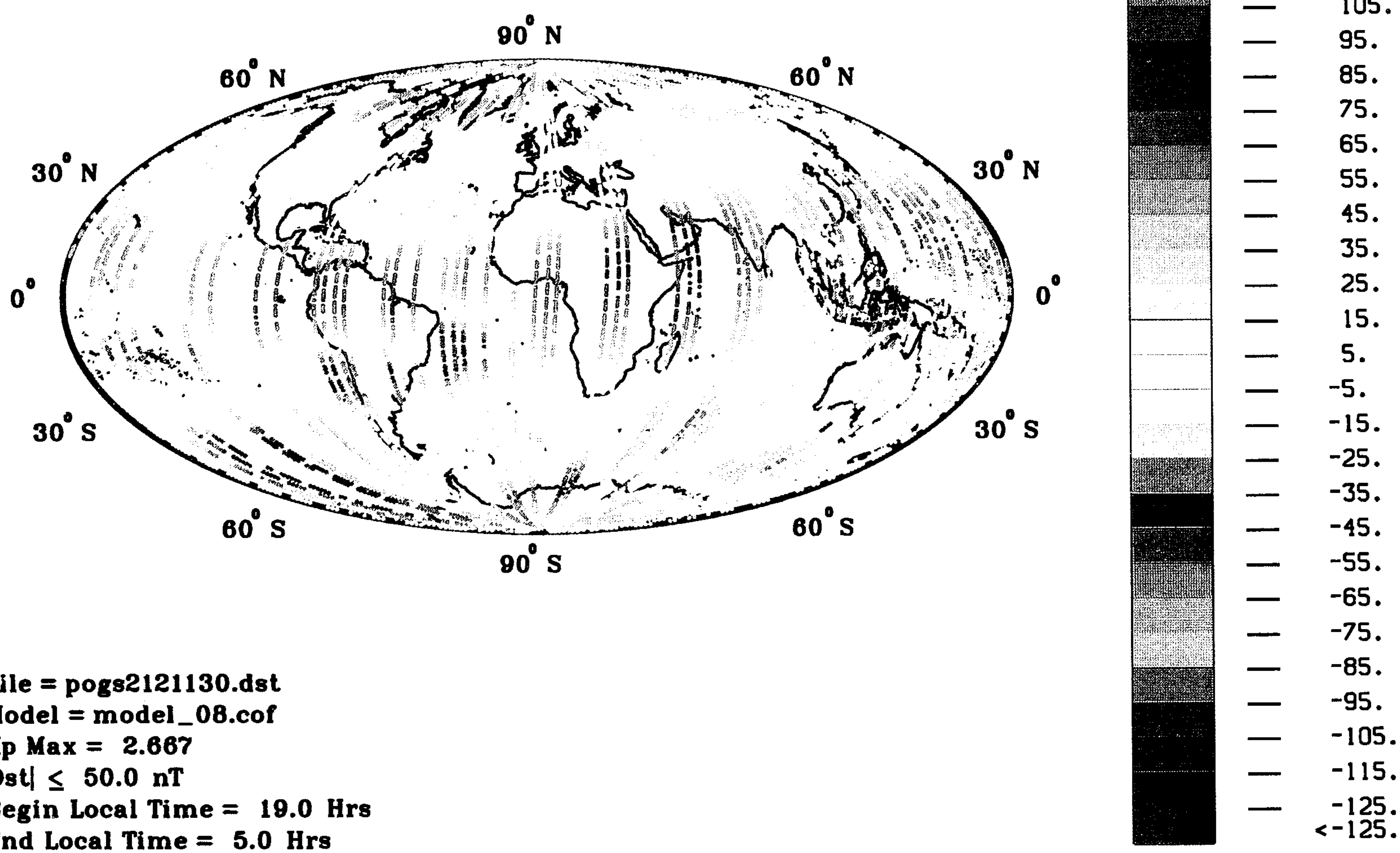


Chart 19. POGS Distribution: 1992, Days 041 - 050, **F** Component Residuals

POGS DISTRIBUTION

(MAGNETIC TOTAL INTENSITY RESIDUALS, UNITS: nT)



File = pogs2121130.dst
Model = model_08.cof
Kp Max = 2.667
|Dst| ≤ 50.0 nT
Begin Local Time = 19.0 Hrs
End Local Time = 5.0 Hrs

Chart 20. POGS Distribution: 1992, Days 121 - 130, **F** Component Residuals

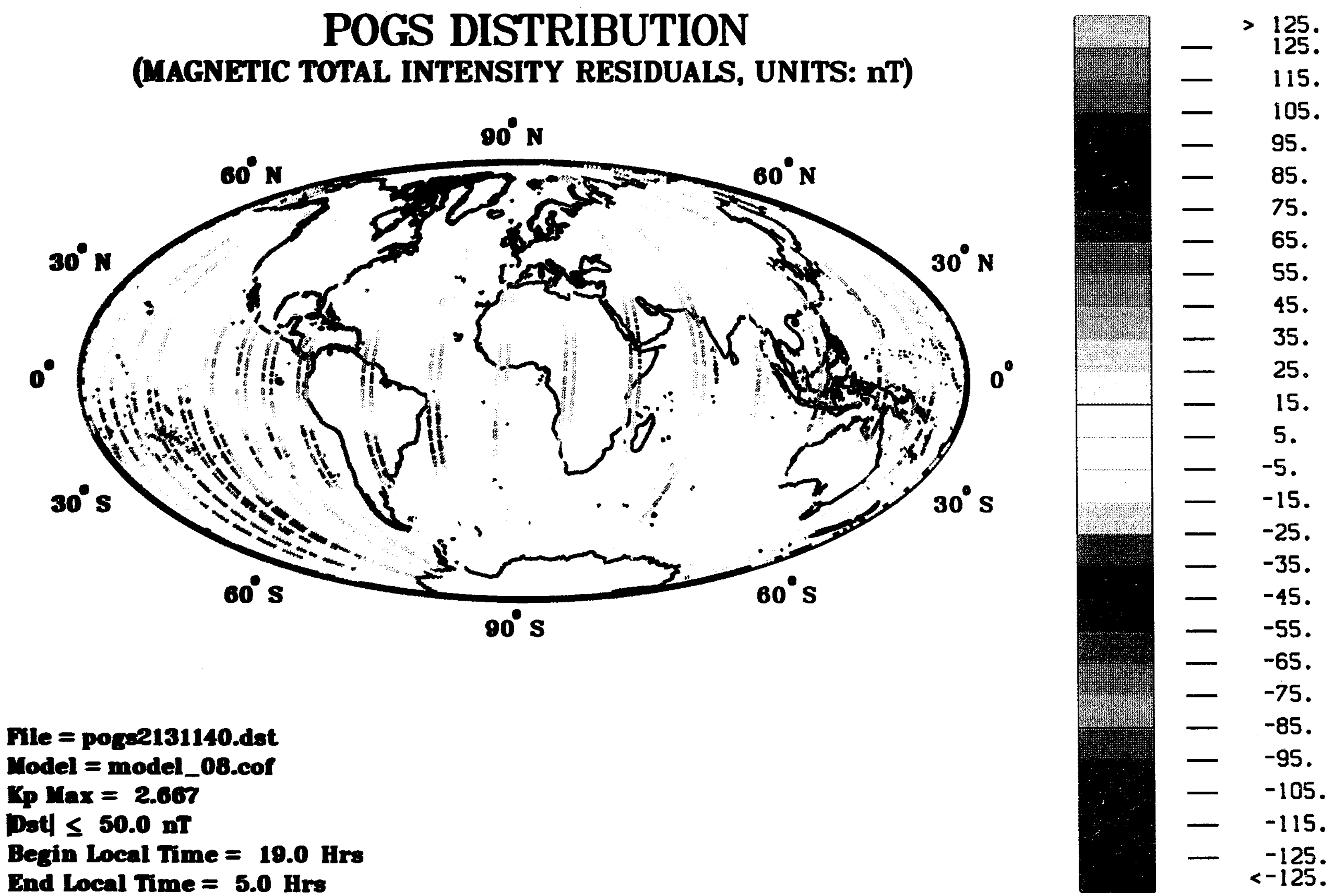
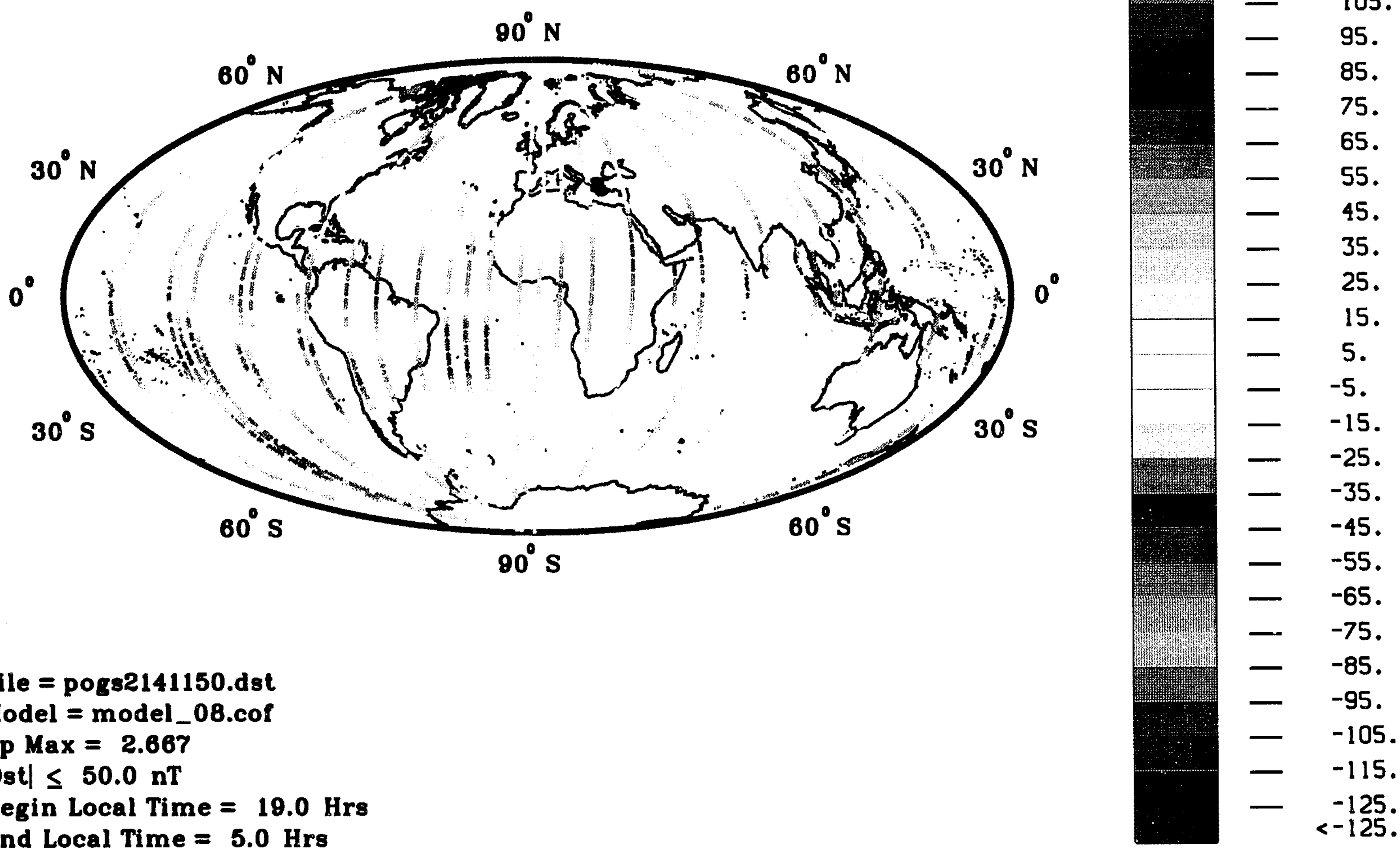


Chart 21. POGS Distribution: 1992, Days 131 - 140, F Component Residuals

POGS DISTRIBUTION

(MAGNETIC TOTAL INTENSITY RESIDUALS, UNITS: nT)



File = pogs2141150.dst
Model = model_08.cof
Kp Max = 2.667
|Dst| ≤ 50.0 nT
Begin Local Time = 19.0 Hrs
End Local Time = 5.0 Hrs

Chart 22. POGS Distribution: 1992, Days 141 - 150, **F** Component Residuals

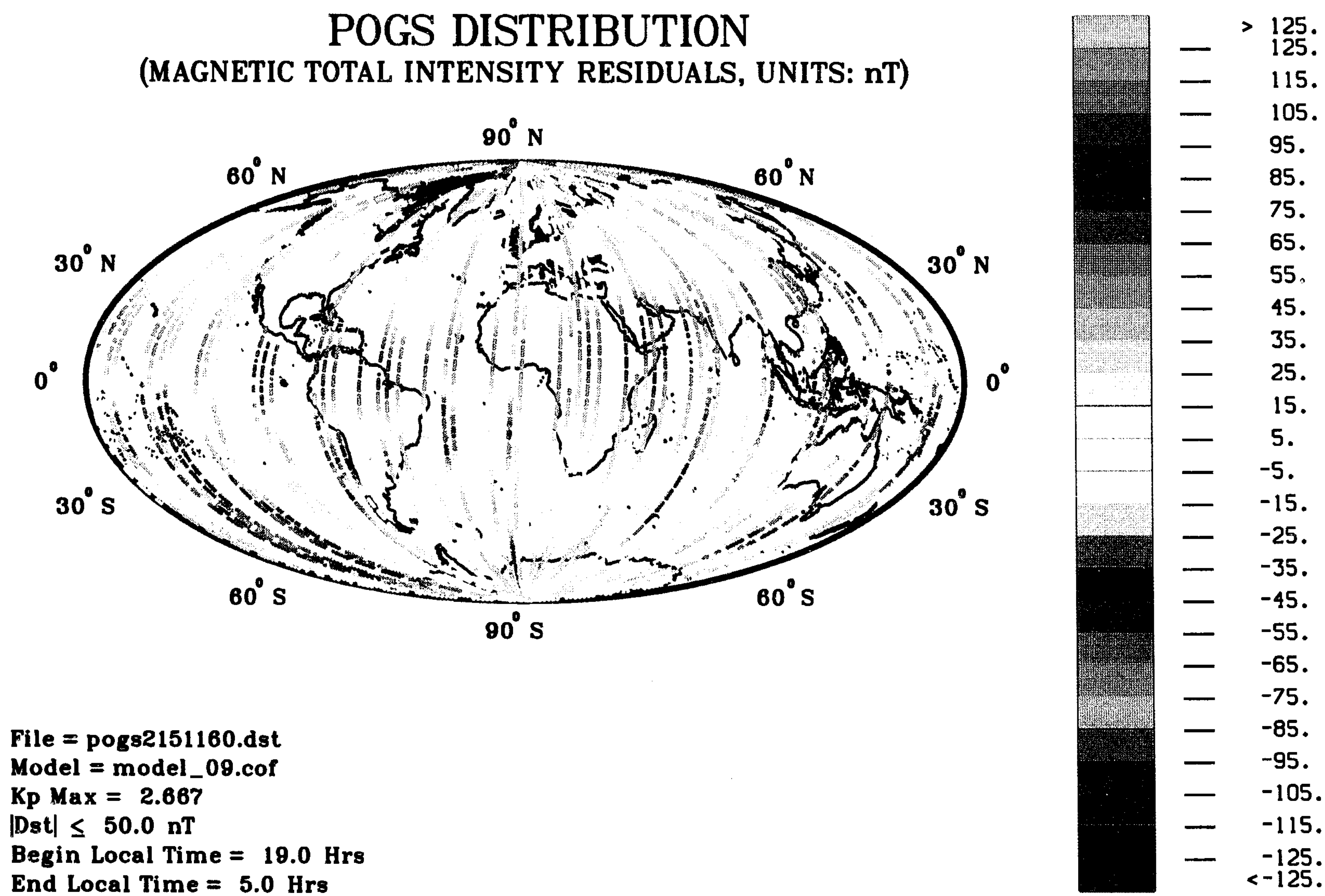


Chart 23. POGS Distribution: 1992, Days 151 - 160, **F** Component Residuals

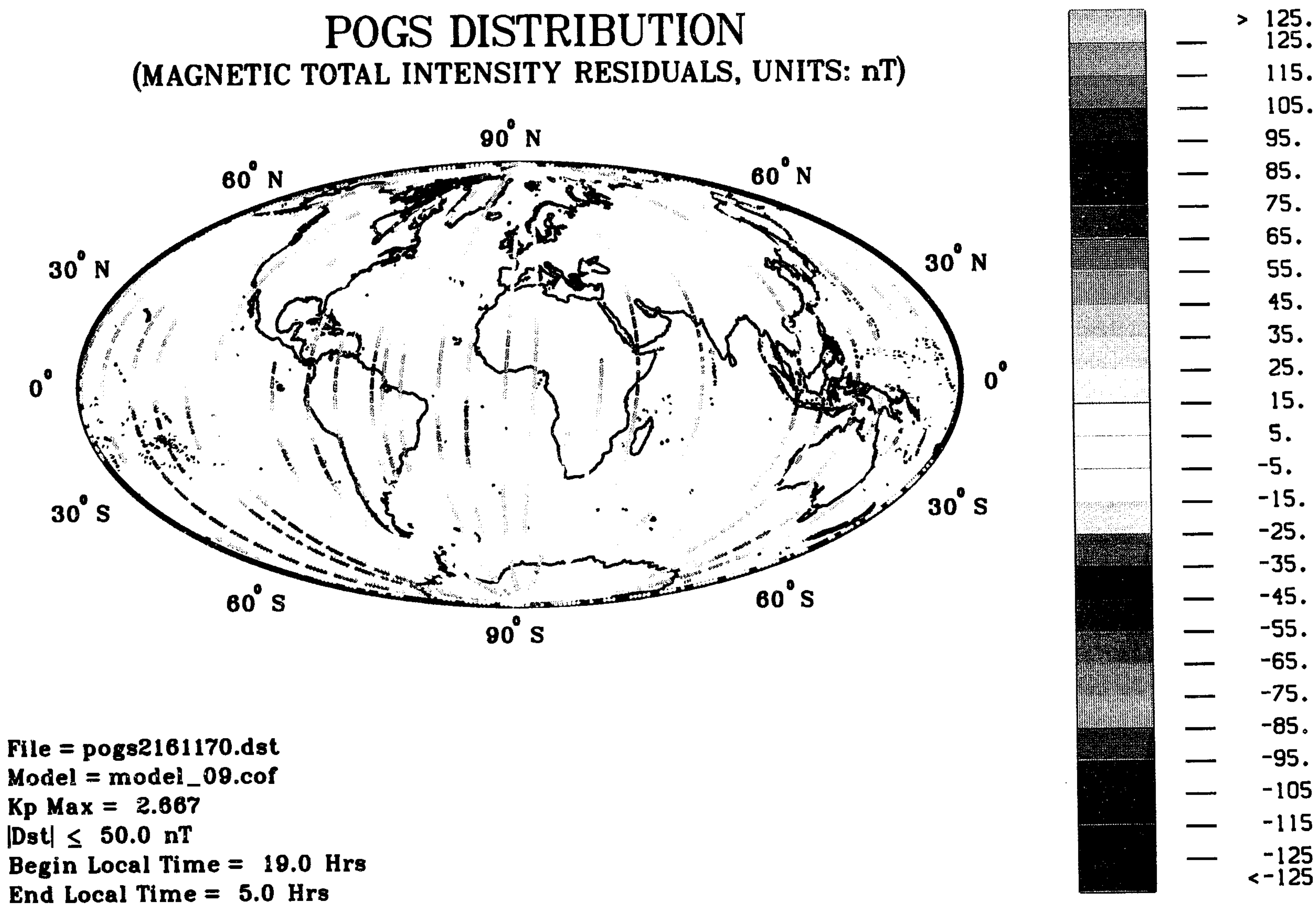


Chart 24. POGS Distribution: 1992, Days 161 - 170, **F** Component Residuals

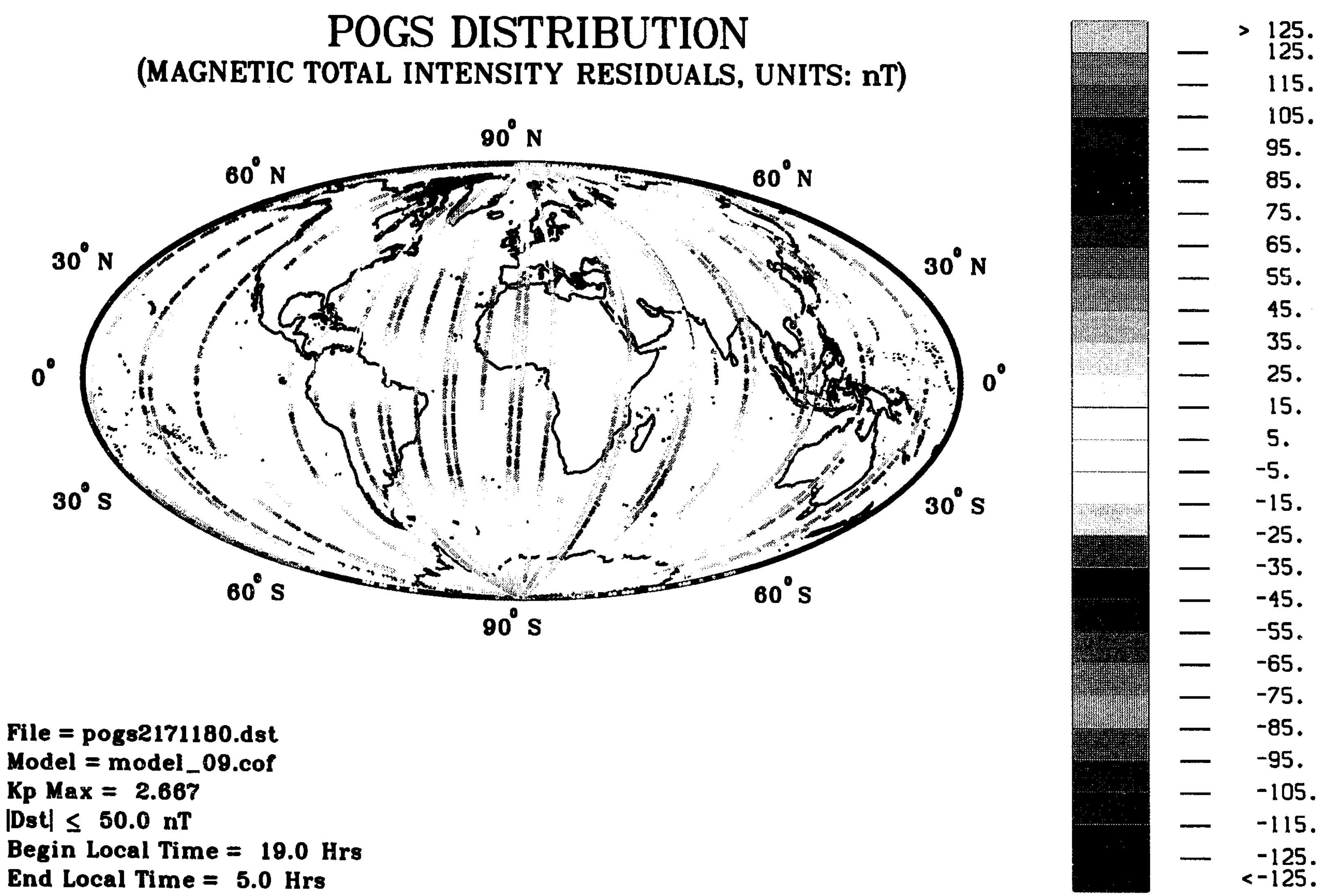


Chart 25. POGS Distribution: 1992, Days 171 - 180, **F** Component Residuals

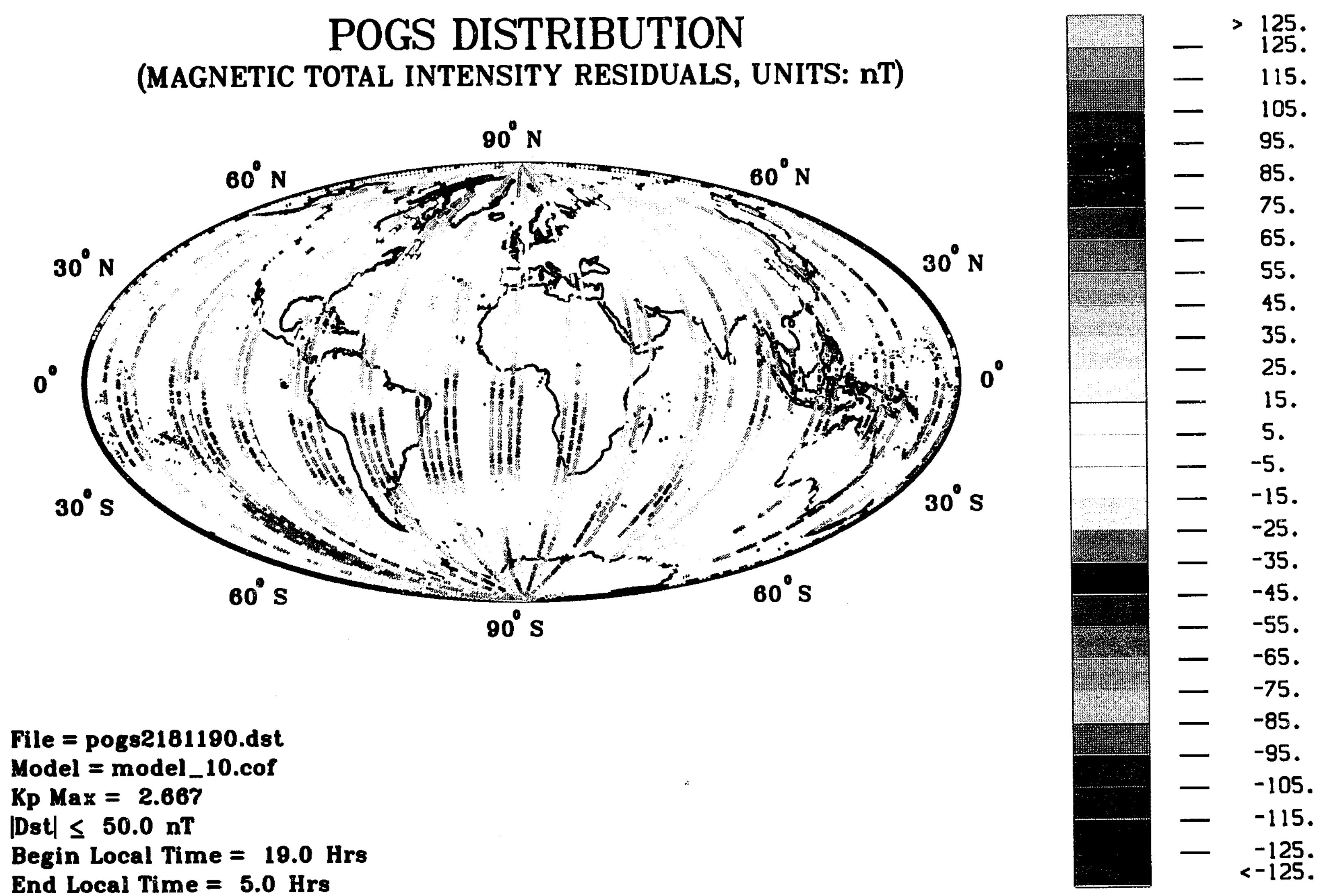


Chart 26. POGS Distribution: 1992, Days 181 - 190, **F** Component Residuals

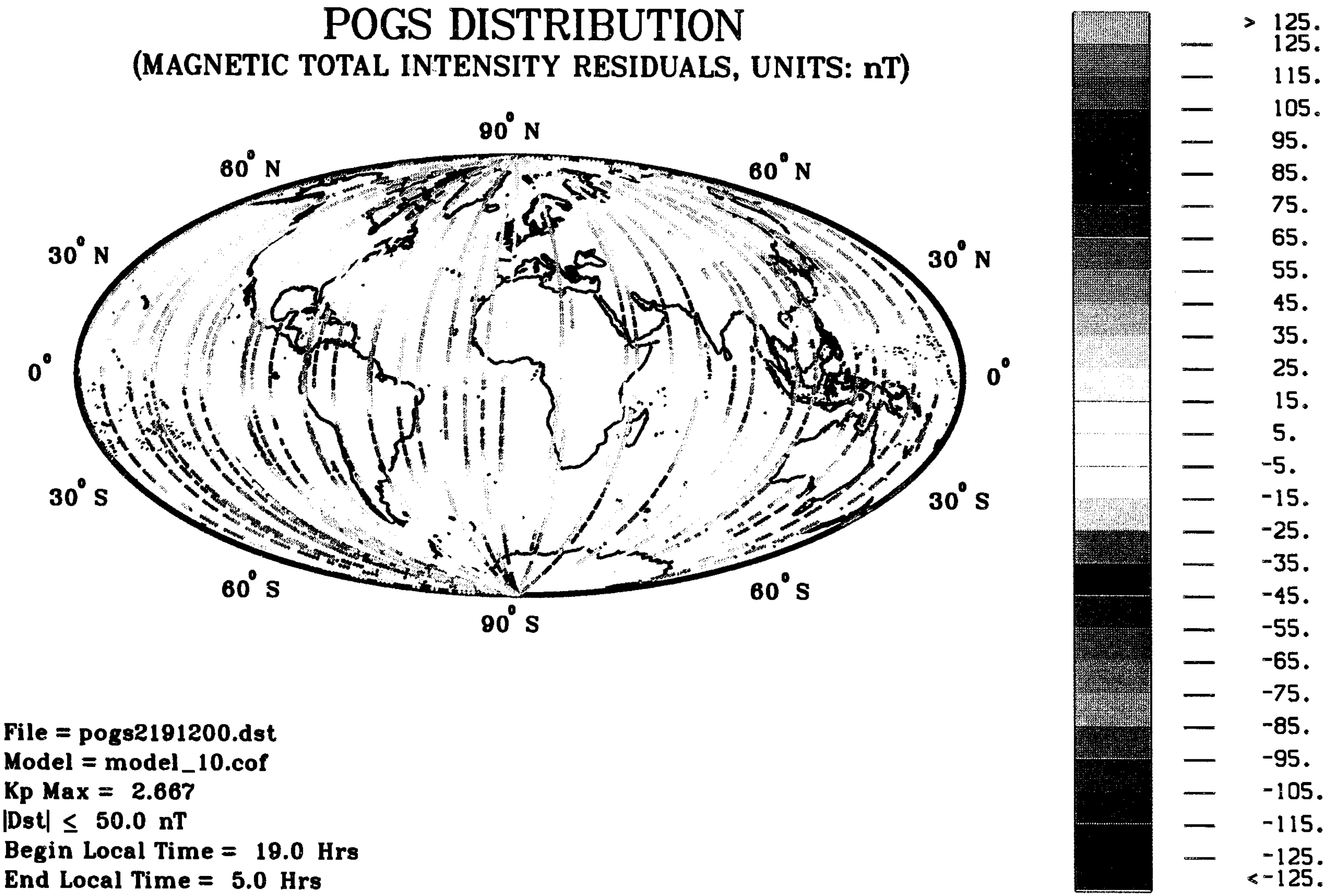


Chart 27. POGS Distribution: 1992, Days 191 - 200, **F** Component Residuals

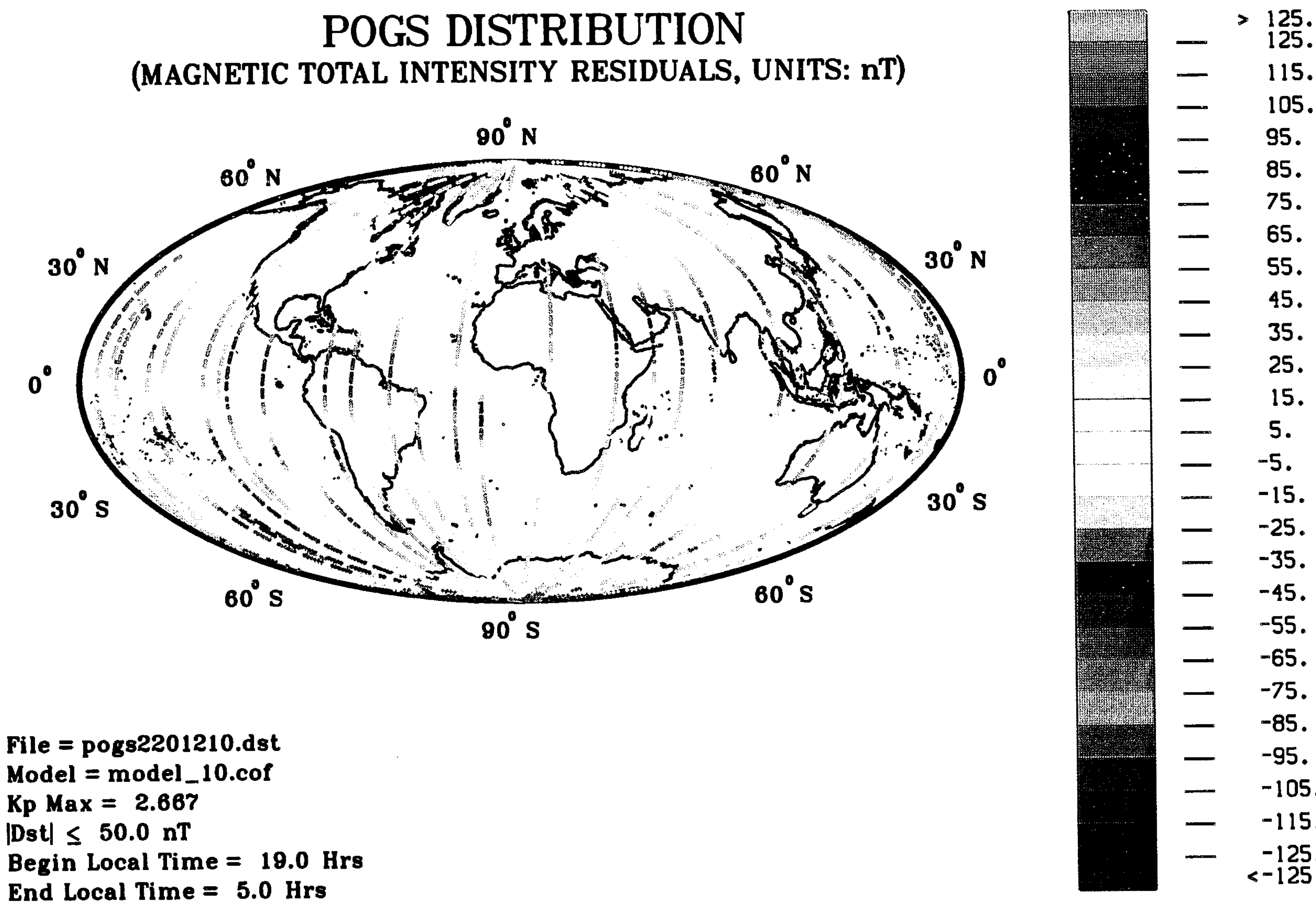


Chart 28. POGS Distribution: 1992, Days 201 - 210, F Component Residuals

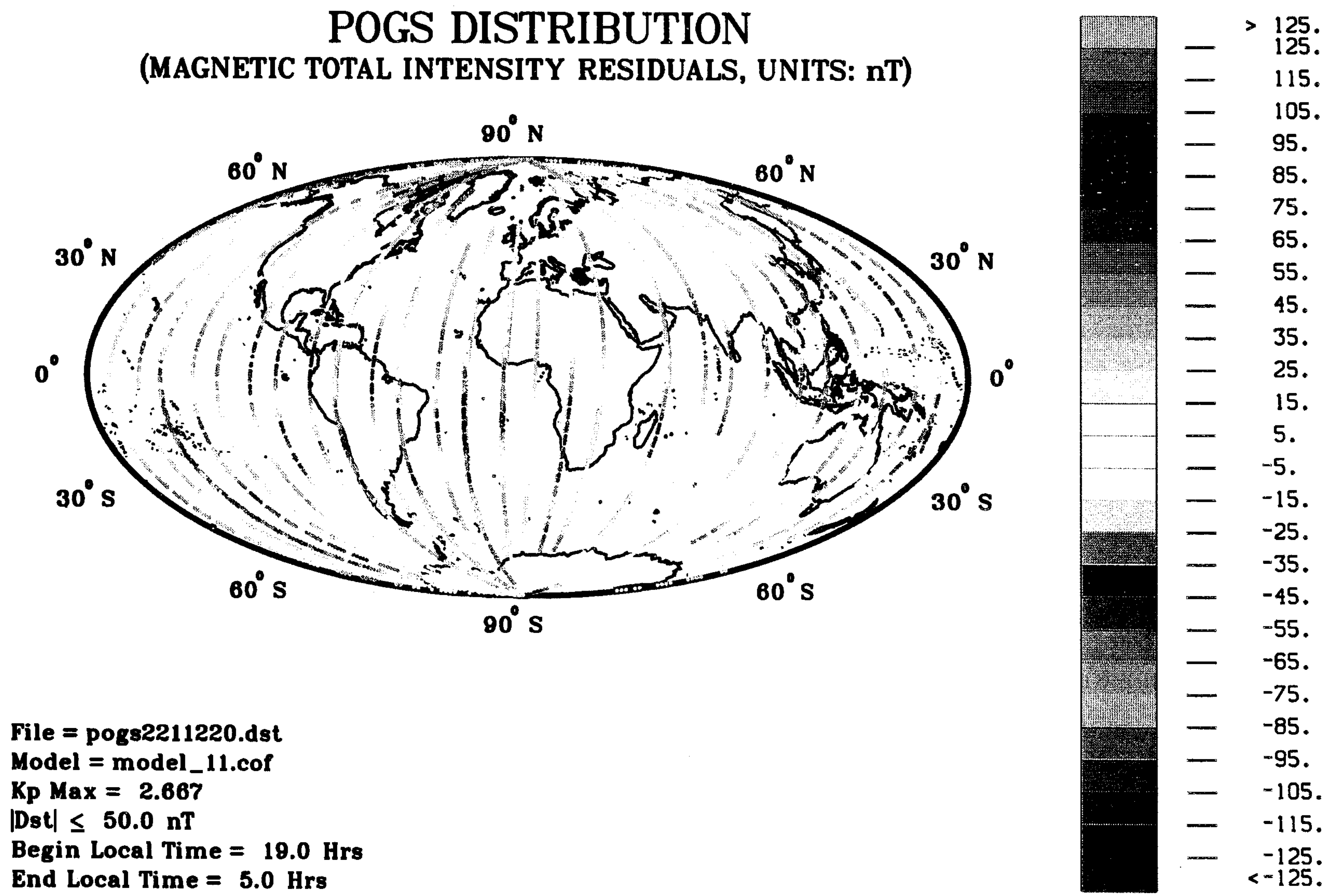


Chart 29. POGS Distribution: 1992, Days 211 - 220, F Component Residuals

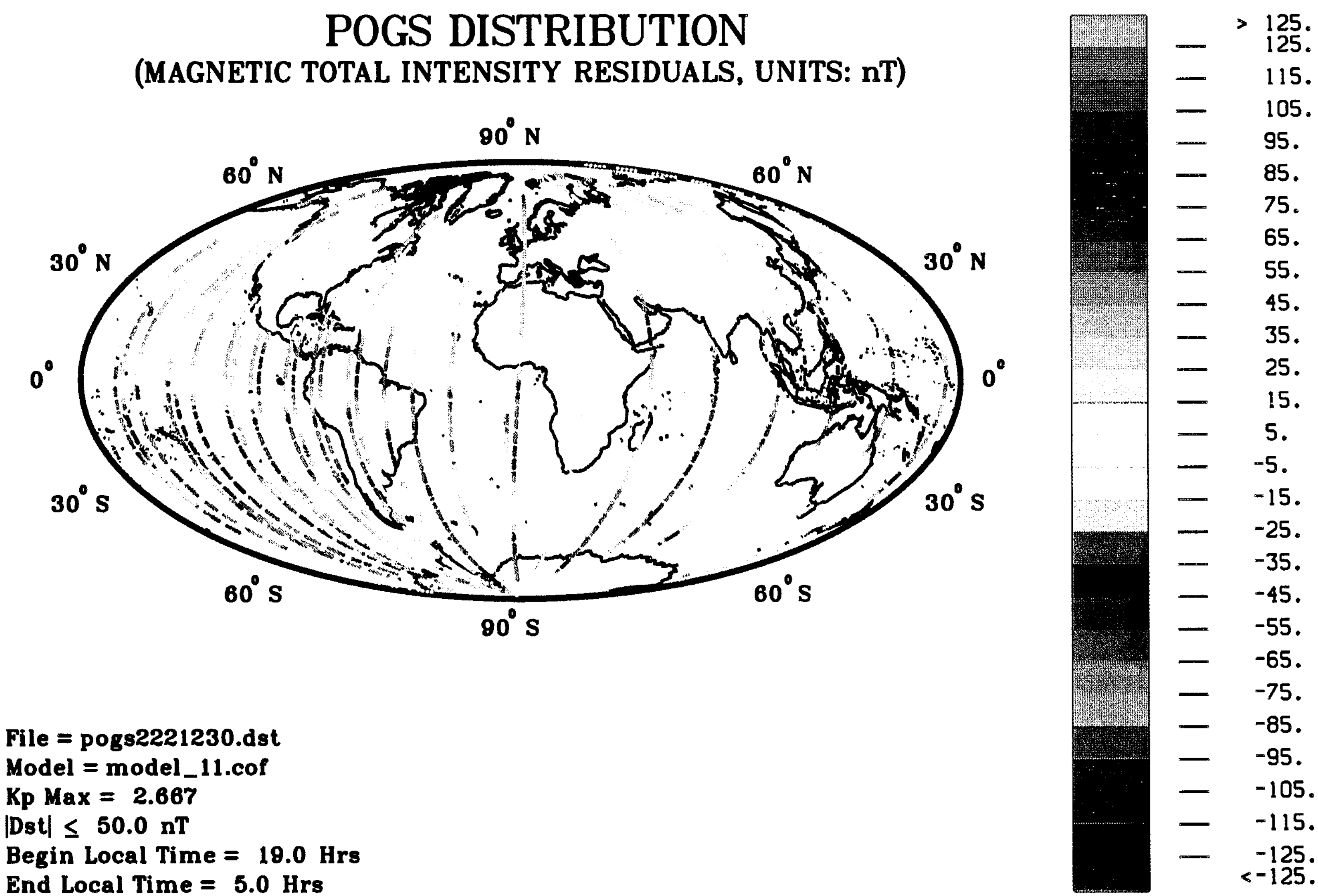


Chart 30. POGS Distribution: 1992, Days 221 - 230, F Component Residuals

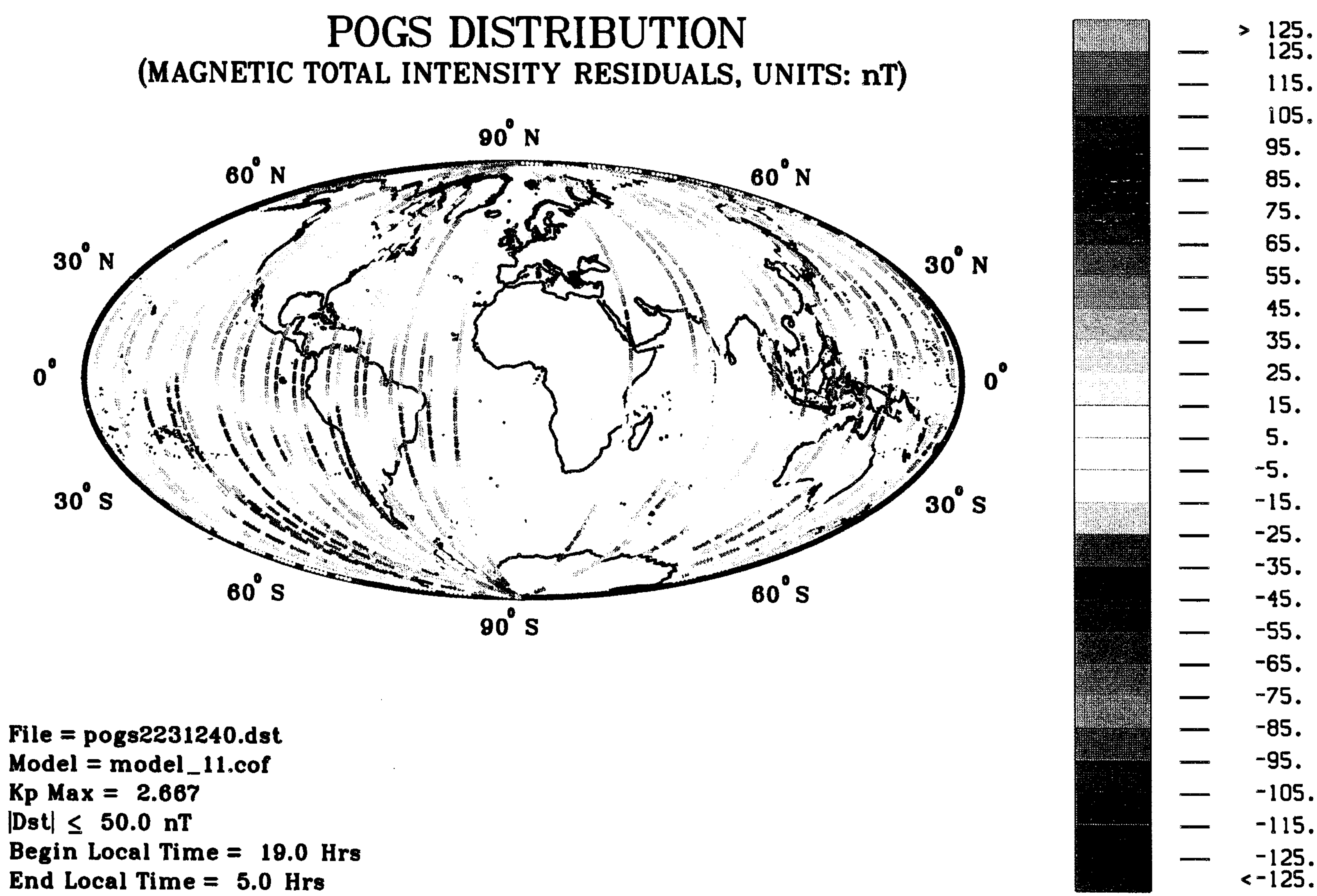


Chart 31. POGS Distribution: 1992, Days 231 - 240, **F** Component Residuals

POGS DISTRIBUTION

(MAGNETIC TOTAL INTENSITY RESIDUALS, UNITS: nT)

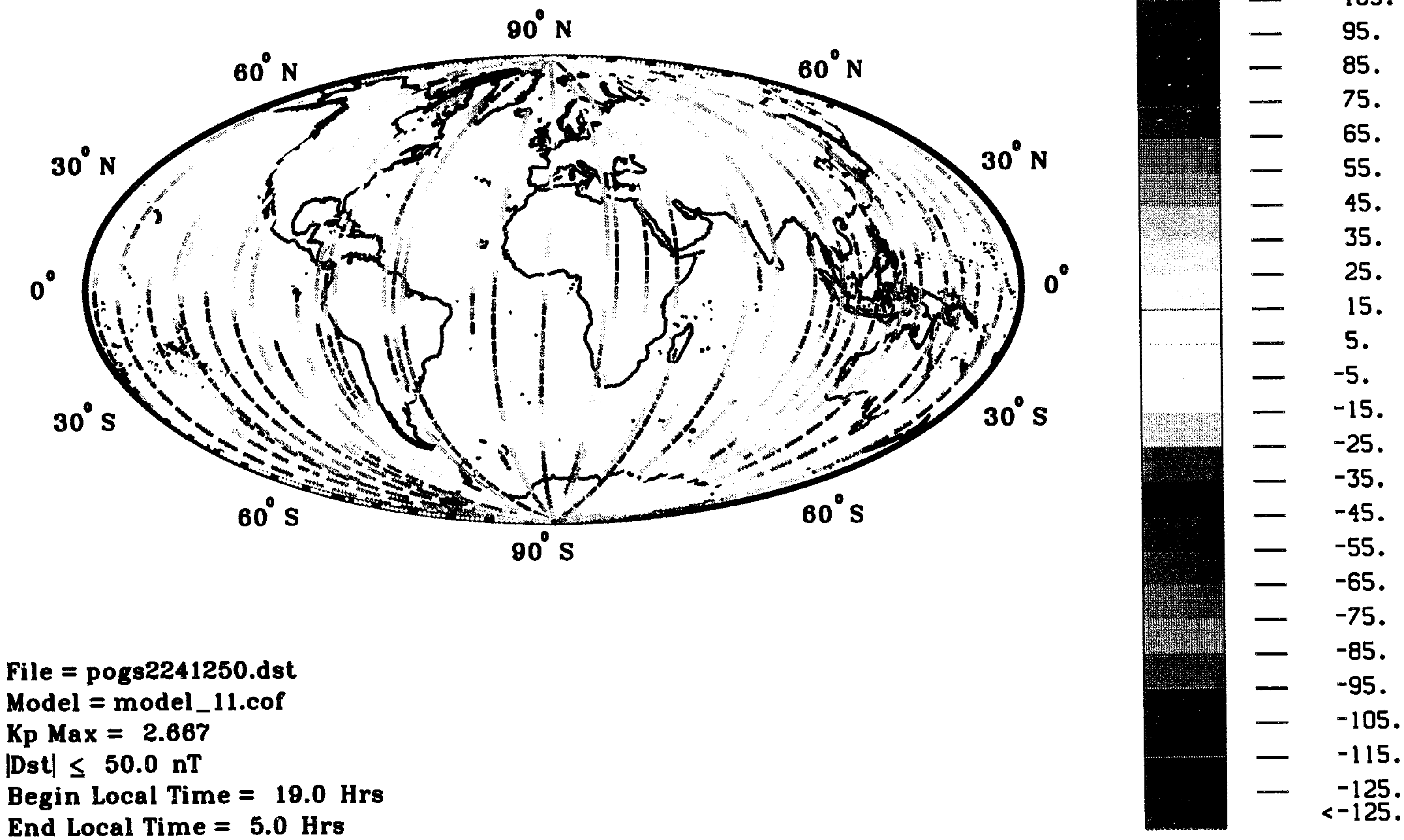


Chart 32. POGS Distribution: 1992, Days 241 - 250, **F** Component Residuals

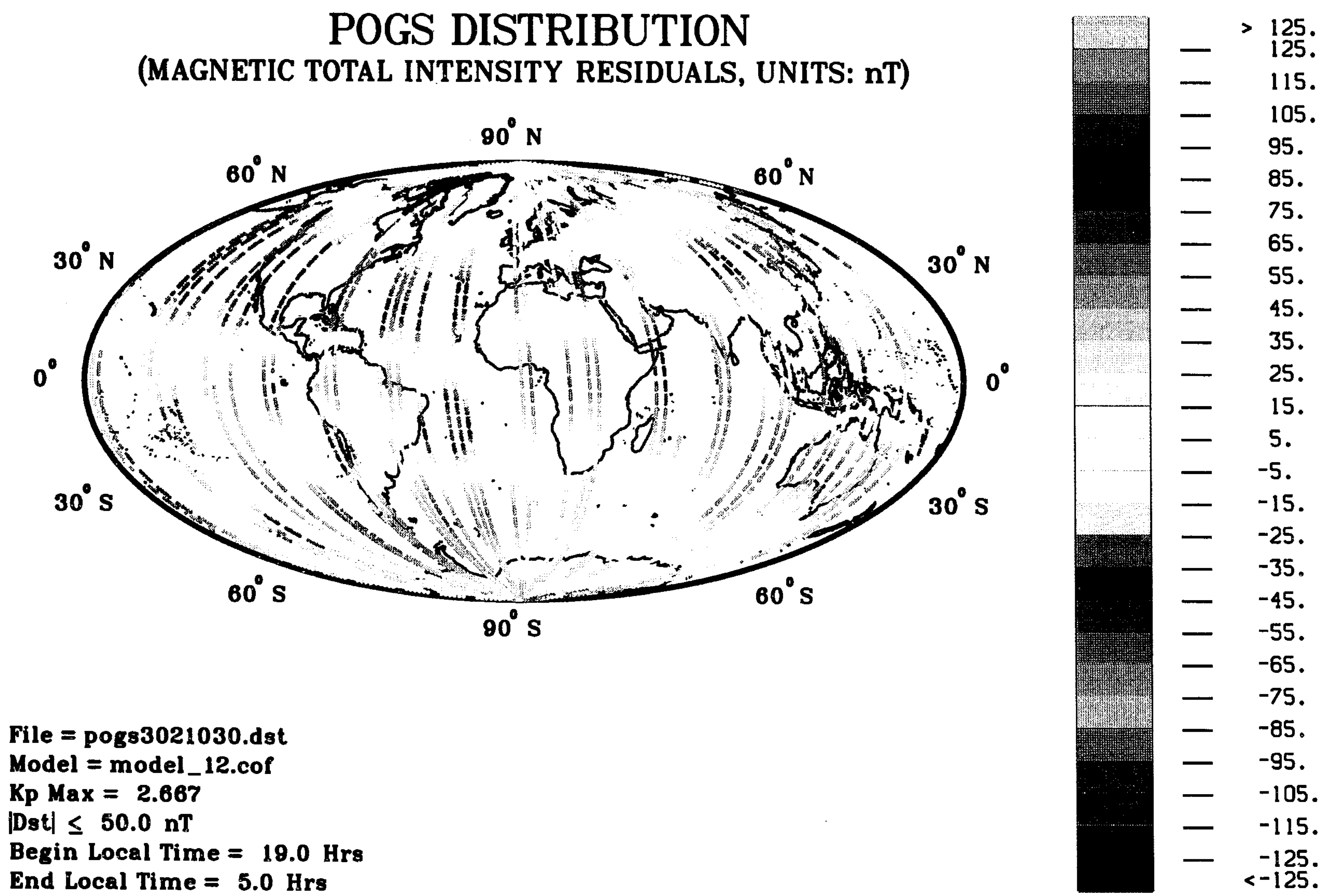


Chart 33. POGS Distribution: 1993, Days 021 - 030, **F** Component Residuals

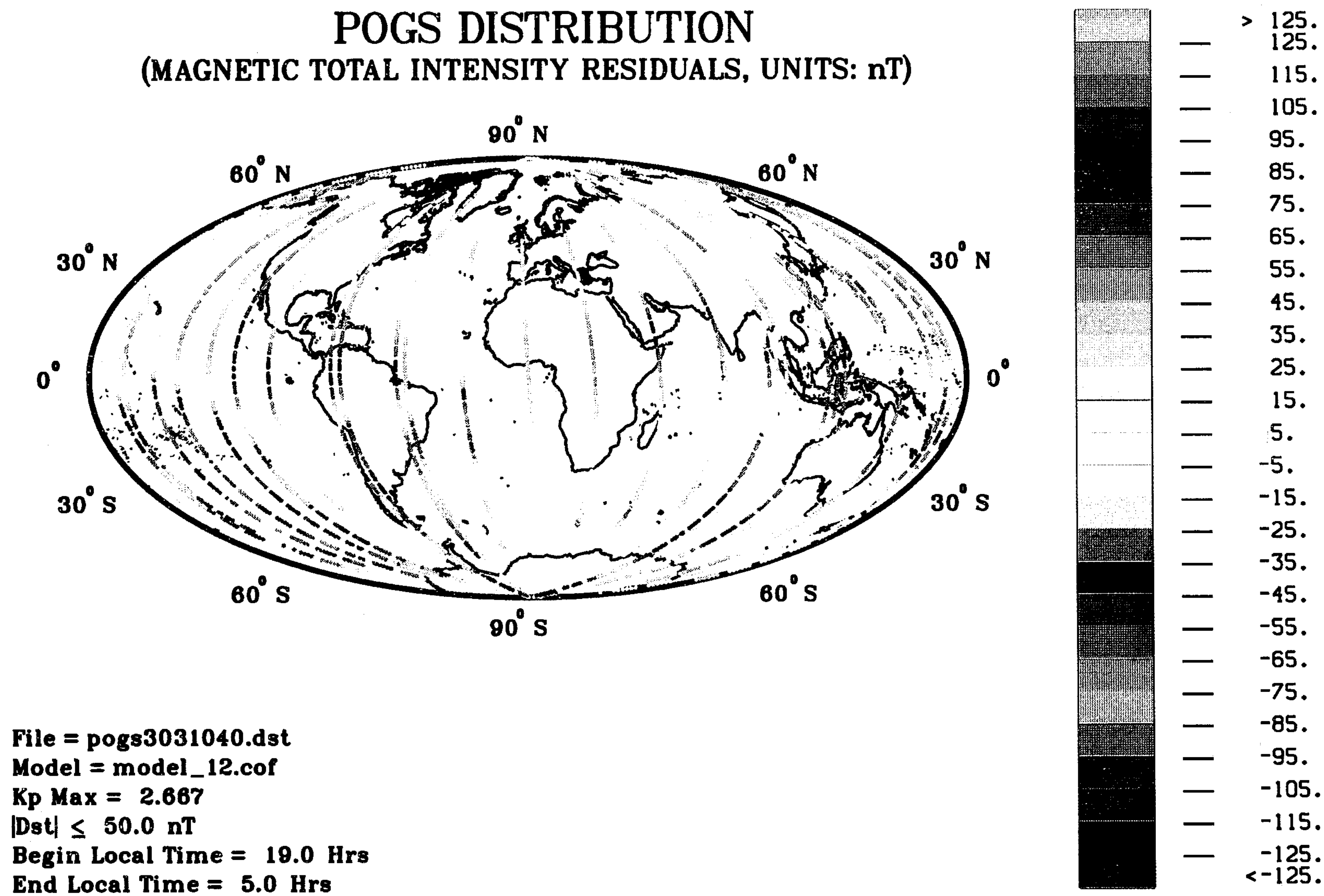
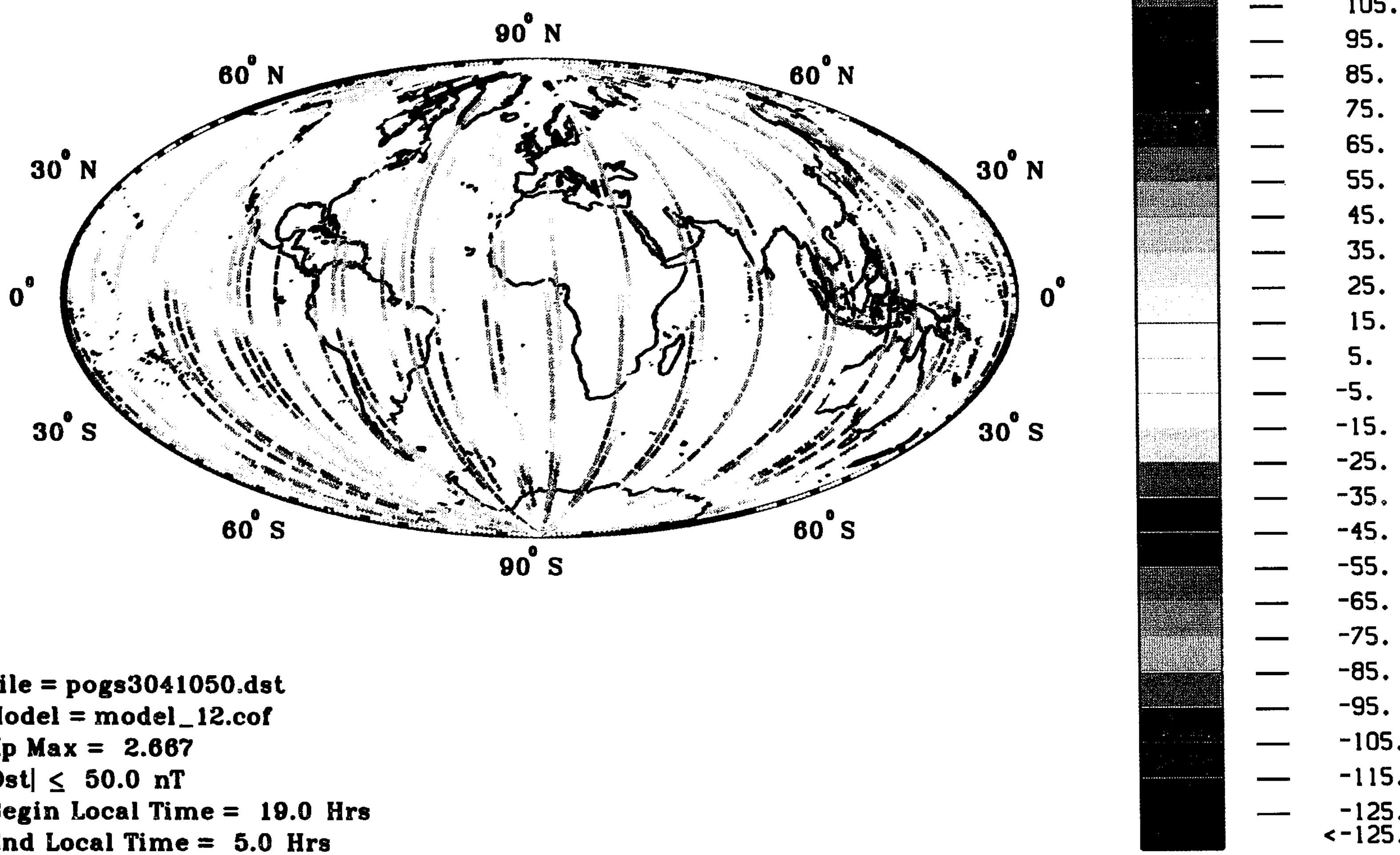


Chart 34. POGS Distribution: 1993, Days 031 - 040, F Component Residuals

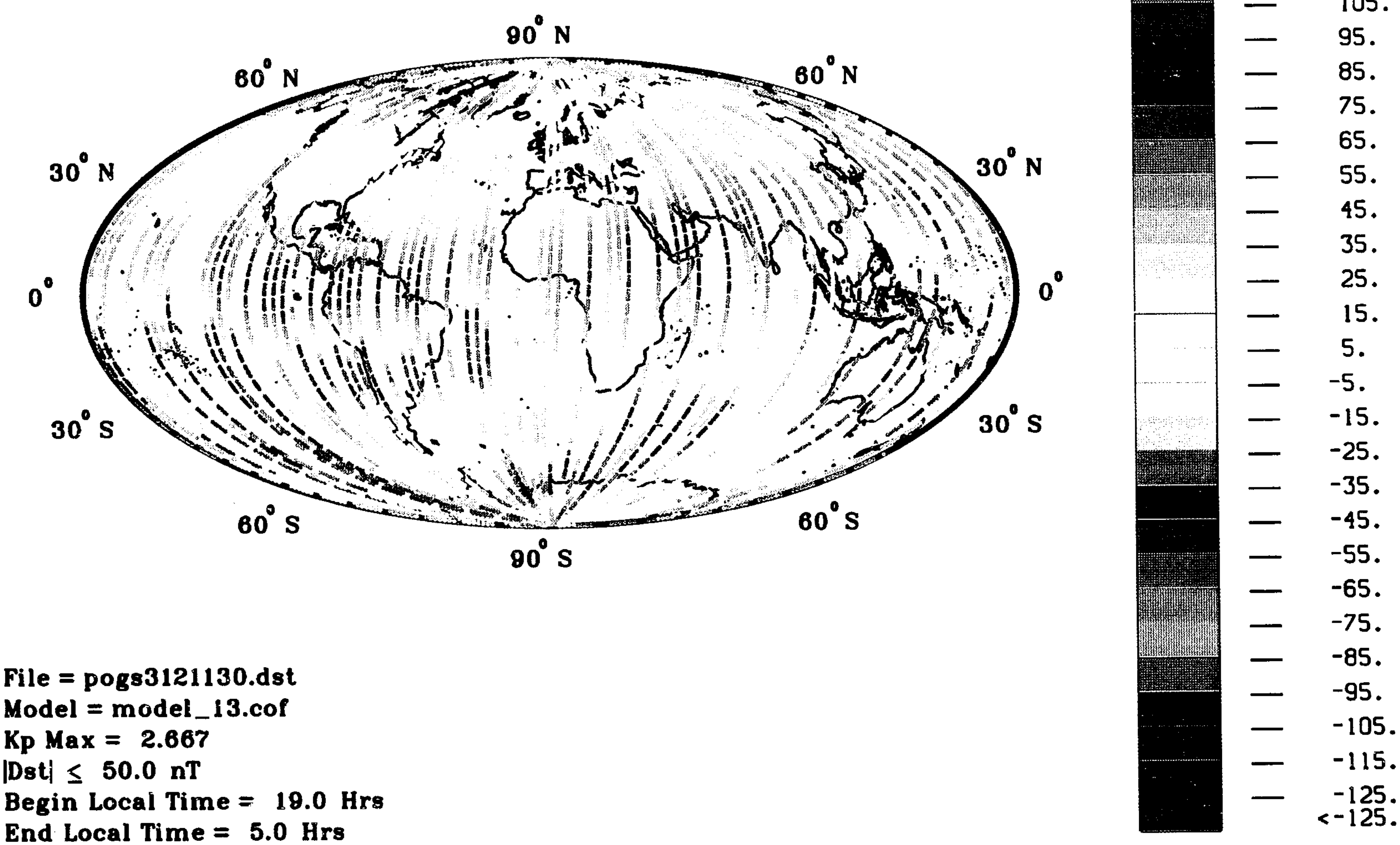
POGS DISTRIBUTION
(MAGNETIC TOTAL INTENSITY RESIDUALS, UNITS: nT)



File = pogs3041050.dst
Model = model_12.cof
Kp Max = 2.667
|Dst| ≤ 50.0 nT
Begin Local Time = 19.0 Hrs
End Local Time = 5.0 Hrs

Chart 35. POGS Distribution: 1993, Days 041 - 050, F Component Residuals

POGS DISTRIBUTION
(MAGNETIC TOTAL INTENSITY RESIDUALS, UNITS: nT)



File = pogs3121130.dst
Model = model_13.cof
Kp Max = 2.667
|Dst| ≤ 50.0 nT
Begin Local Time = 19.0 Hrs
End Local Time = 5.0 Hrs

Chart 36. POGS Distribution: 1993, Days 121 - 130, F Component Residuals

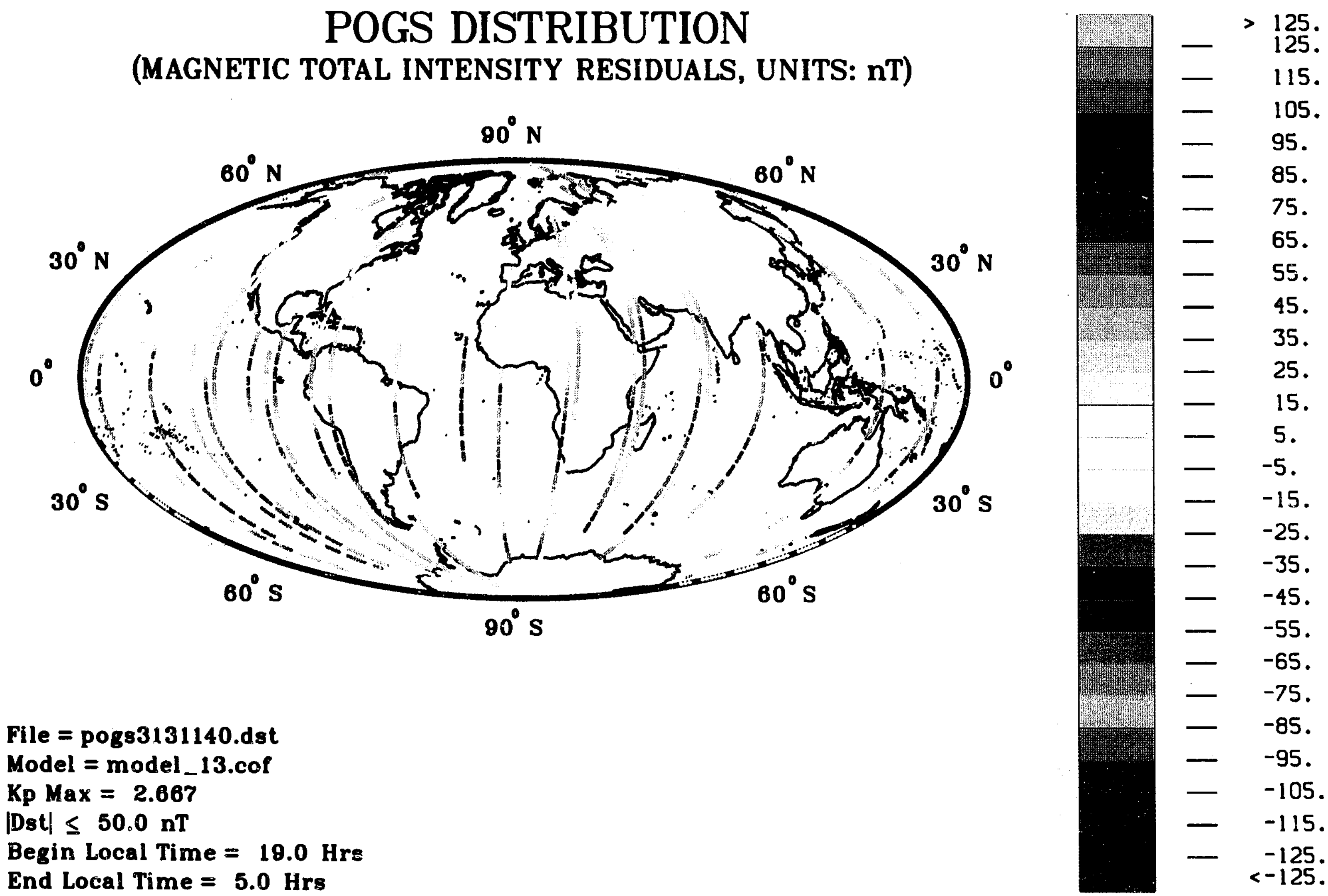


Chart 37. POGS Distribution: 1993, Days 131 - 140, **F** Component Residuals

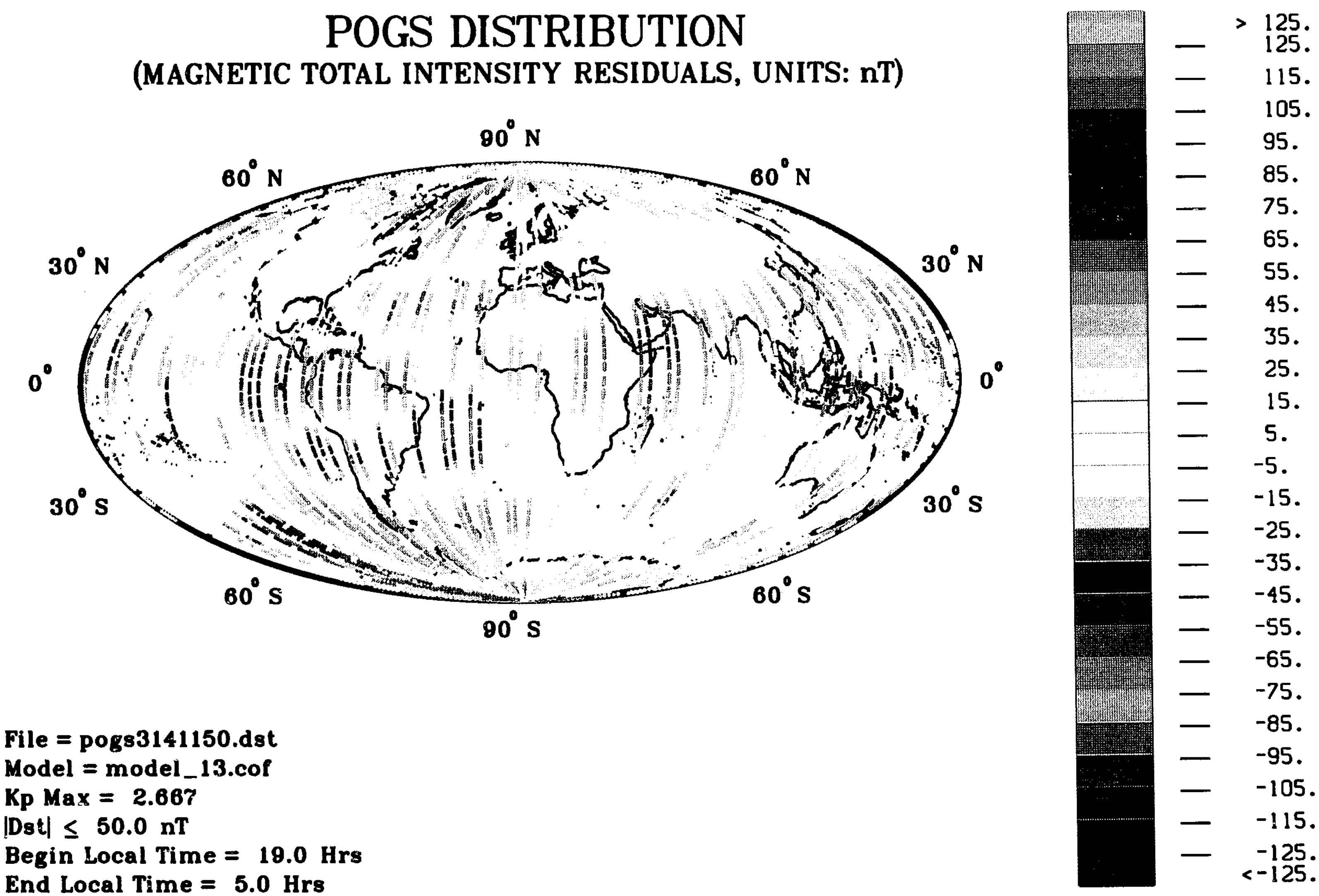


Chart 38. POGS Distribution: 1993, Days 141 - 150, F Component Residuals

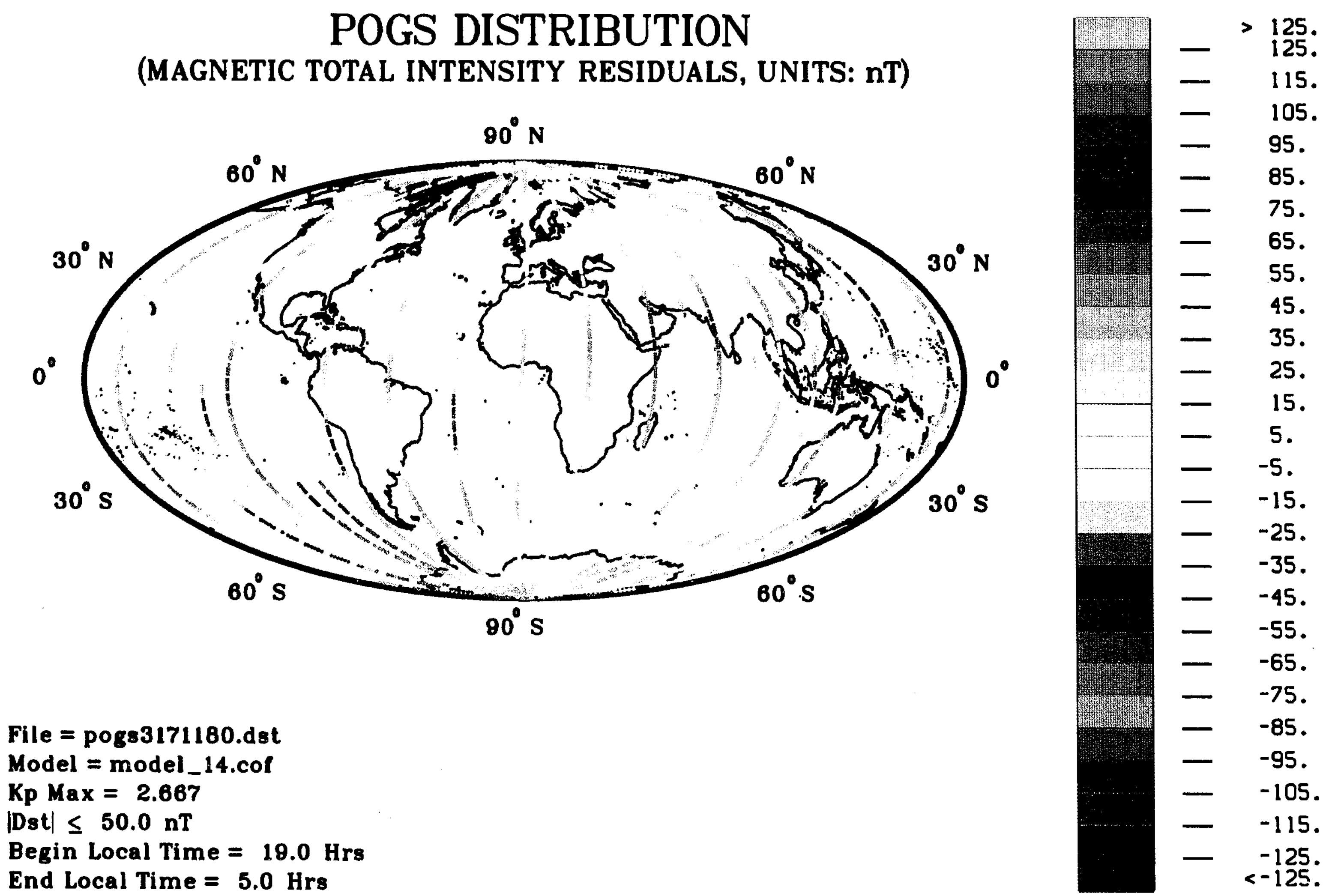


Chart 39. POGS Distribution: 1993, Days 171 - 180, **F** Component Residuals

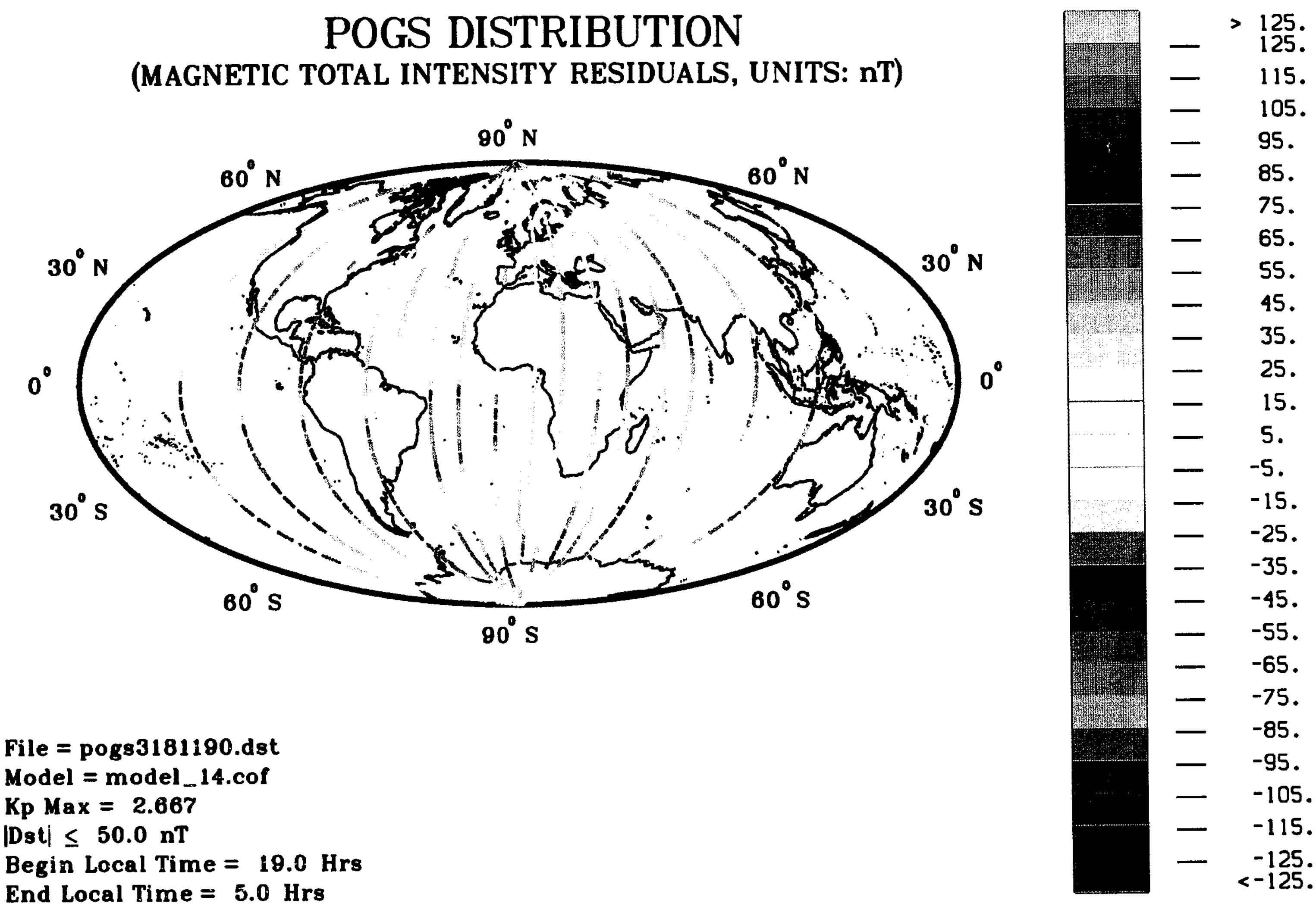


Chart 40. POGS Distribution: 1993, Days 181 - 190, F Component Residuals

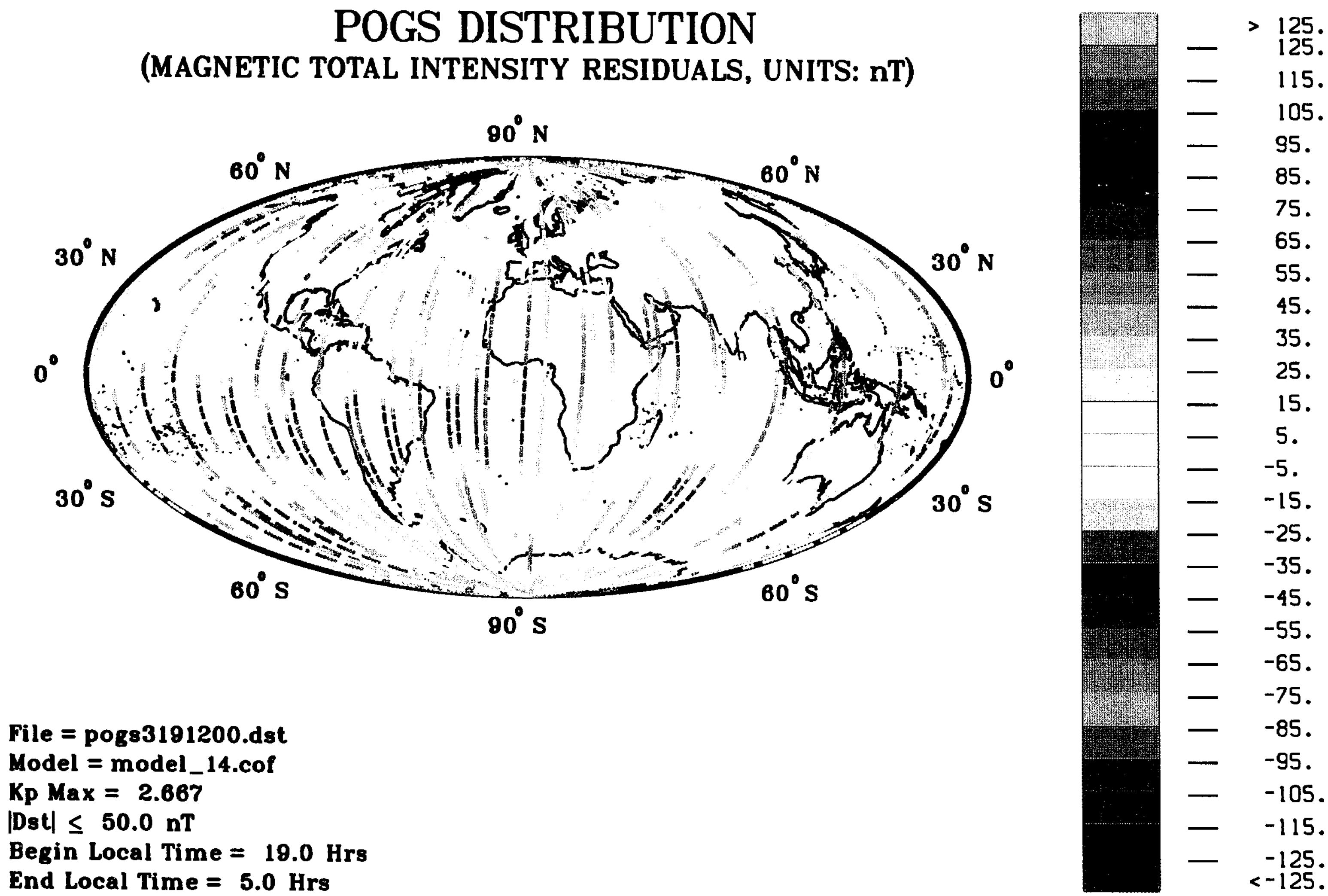


Chart 41. POGS Distribution: 1993, Days 191 - 200, **F** Component Residuals

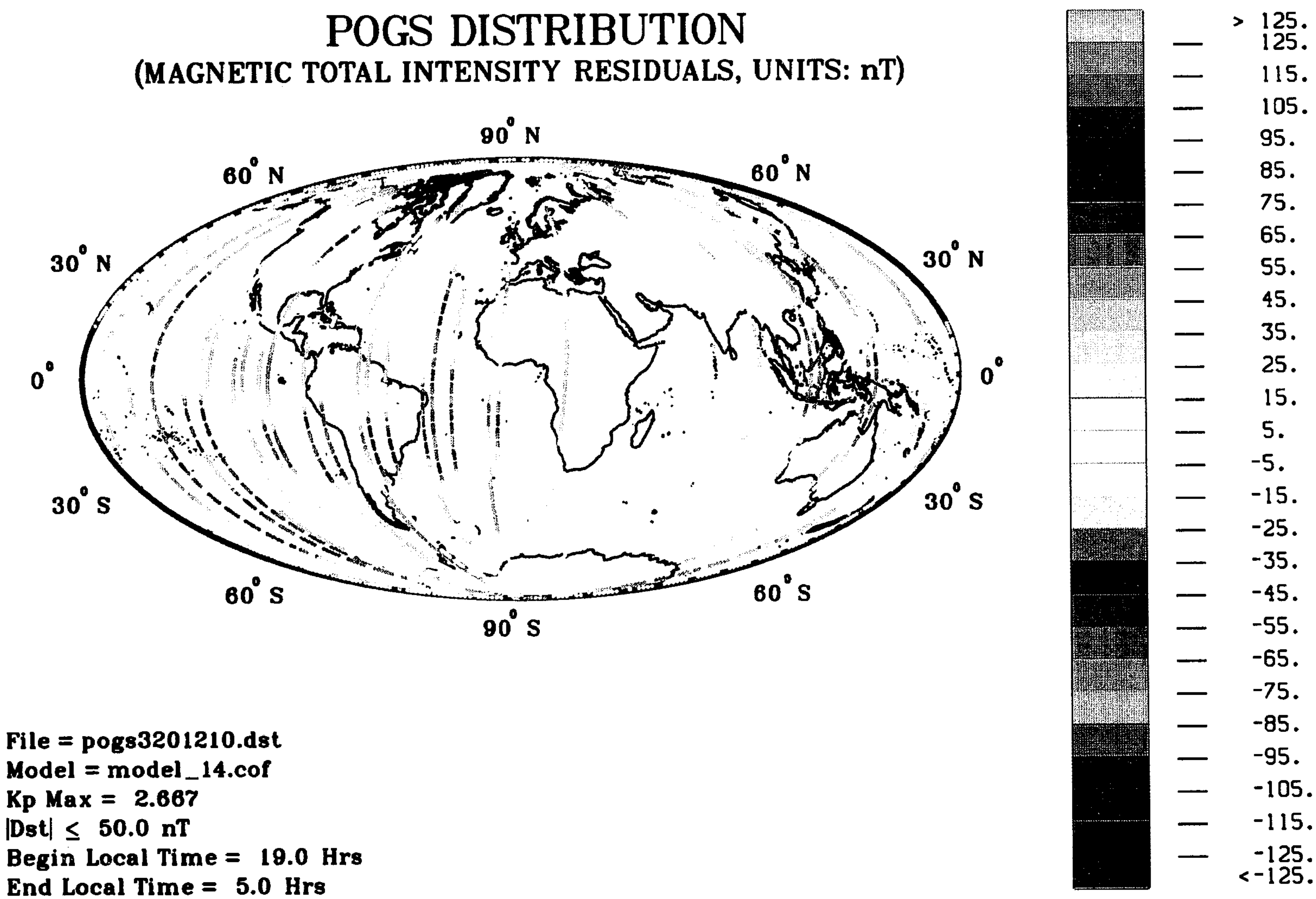


Chart 42. POGS Distribution: 1993, Days 201 - 210, F Component Residuals

contain the value of M. Sugiura's Dst(0) index divided, rather than multiplied, by the cosine of the geomagnetic latitude. This is not a serious problem since Sugiura's original equatorial Dst index can be recovered by multiplying the POGS Dst values by the cosine of the geomagnetic latitude. One simply needs to be aware of how the data has been treated. The geomagnetic coordinates used for this purpose were from the 1990 Epoch. The Dst index has a range of $\pm$ 1000 nT and perhaps higher during extremely active periods.

The WMM-95 modeling effort actually used the POGS Dst values for data selection. Consequently, the data selection criteria became more stringent approaching the geomagnetic poles than originally intended. This was actually beneficial since less geomagnetically active Auroral Zone data were selected, while, as charts 1 through 42 indicate, no noticeable deterioration in the selected POGS data distribution was observed near the magnetic poles. The color scheme on the POGS data distribution charts corresponds to magnetic Total-Intensity residuals, computed with respect to *initial* POGS-based models which, as input data, used the POGS file indicated in the chart legend and other files nearby in time. As indicated in each chart legend, the POGS data are organized into 10-day files. For example, the file: pogs2121130.dst corresponds to the year 1992 and covers days 121 through 130. The extension "dst" indicates that the equatorial value of the Dst index (*divided* by the cosine of the geomagnetic latitude) and the Kp index are both attached to each data record within the 10-day data file.

On the other hand, Project MAGNET data are not considered temporally coherent, and by design, these data are primarily confined to latitude bands that straddle the geomagnetic equator although excursions to the North Magnetic Pole and to the South Magnetic Pole were made, as is indicated in Aitoff equal-area charts 43a-d and 44a-d. In the equatorial band the data distribution is considered reasonably uniform and of sufficient density for degree 12 spherical-harmonic modeling when combined with POGS data. Charts 43a-d display Project MAGNET data coverage for the X, Y, Z, and F magnetic components of the C32 projects indicated in the chart legends. These surveys span the time interval from the fourth quarter of calendar year 1988 through the third quarter of calendar year 1990. Charts 44a-d display Project MAGNET data coverage for the X, Y, Z, and F magnetic field components of the D32 projects indicated in the chart legends. These surveys span the time interval from the first quarter through the fourth quarter of calendar year 1993. An additional set of Project MAGNET data was collected during the first calendar quarter of 1994 but was not processed in time to use in the 1995 Epoch model. The project numbers on these charts correspond to Fiscal Years (FY), which start in October. Thus, Project 352 corresponds to the second quarter of FY93. The "5" is an aircraft designator. It corresponds to the fifth aircraft used in the Project MAGNET program. The color code on these charts corresponds to the magnetic field residuals with respect to a *modified* 1990 Epoch model generated in May 1994. It will be discussed shortly. Note that the Y-component appears to be biased for many flights. This appears to have been the result of a bias in the inertial attitude device on the aircraft. Consequently, this component received less weight in the modeling process. In contrast to the POGS data, the aeromagnetic data were not selected on the basis of either the Kp or Dst index. Instead, the aircraft is flown at night, and as far as it was possible to do so, data were collected during periods of low solar activity.

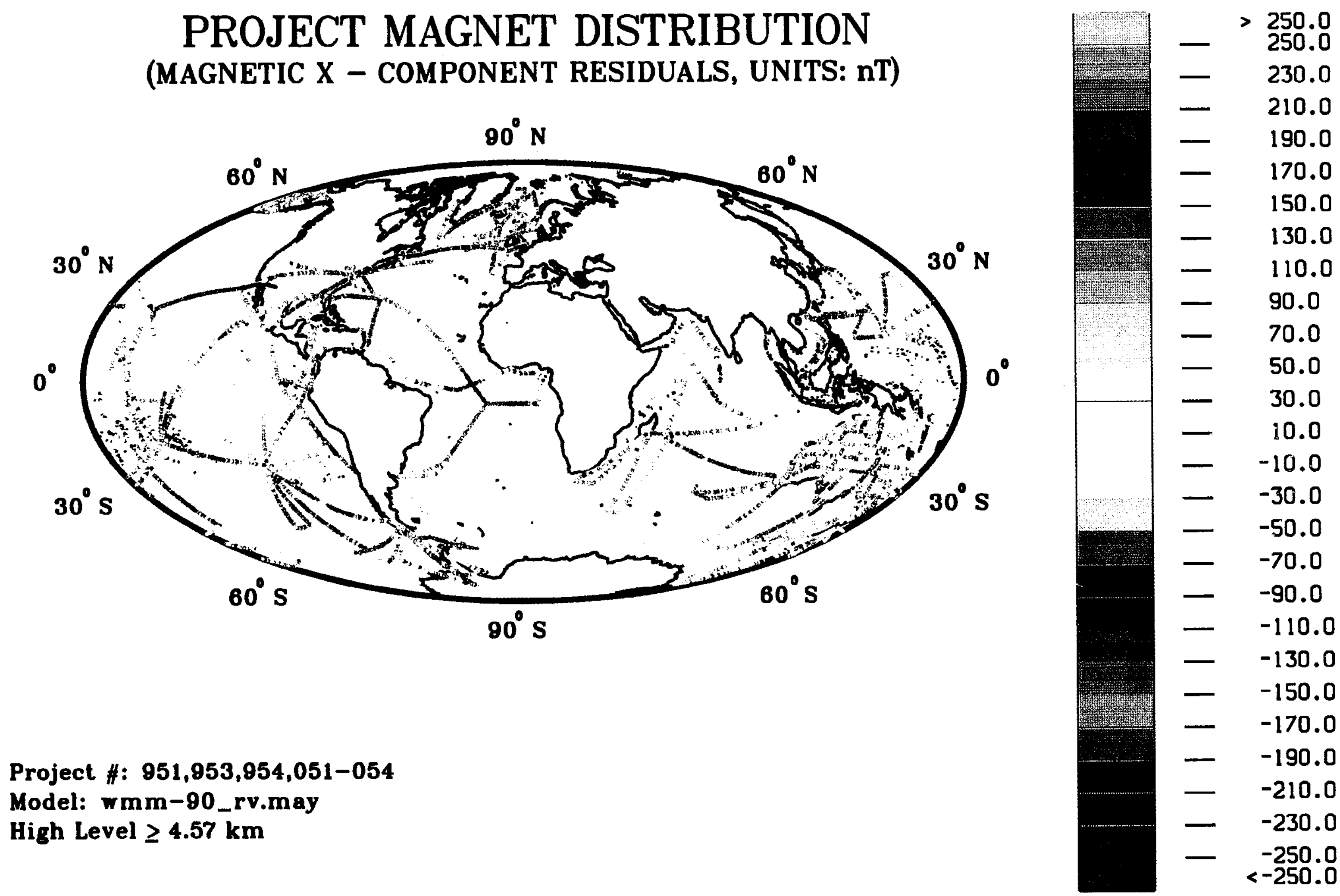


Chart 43a. C32 Project MAGNET Distribution: X - Component Residuals

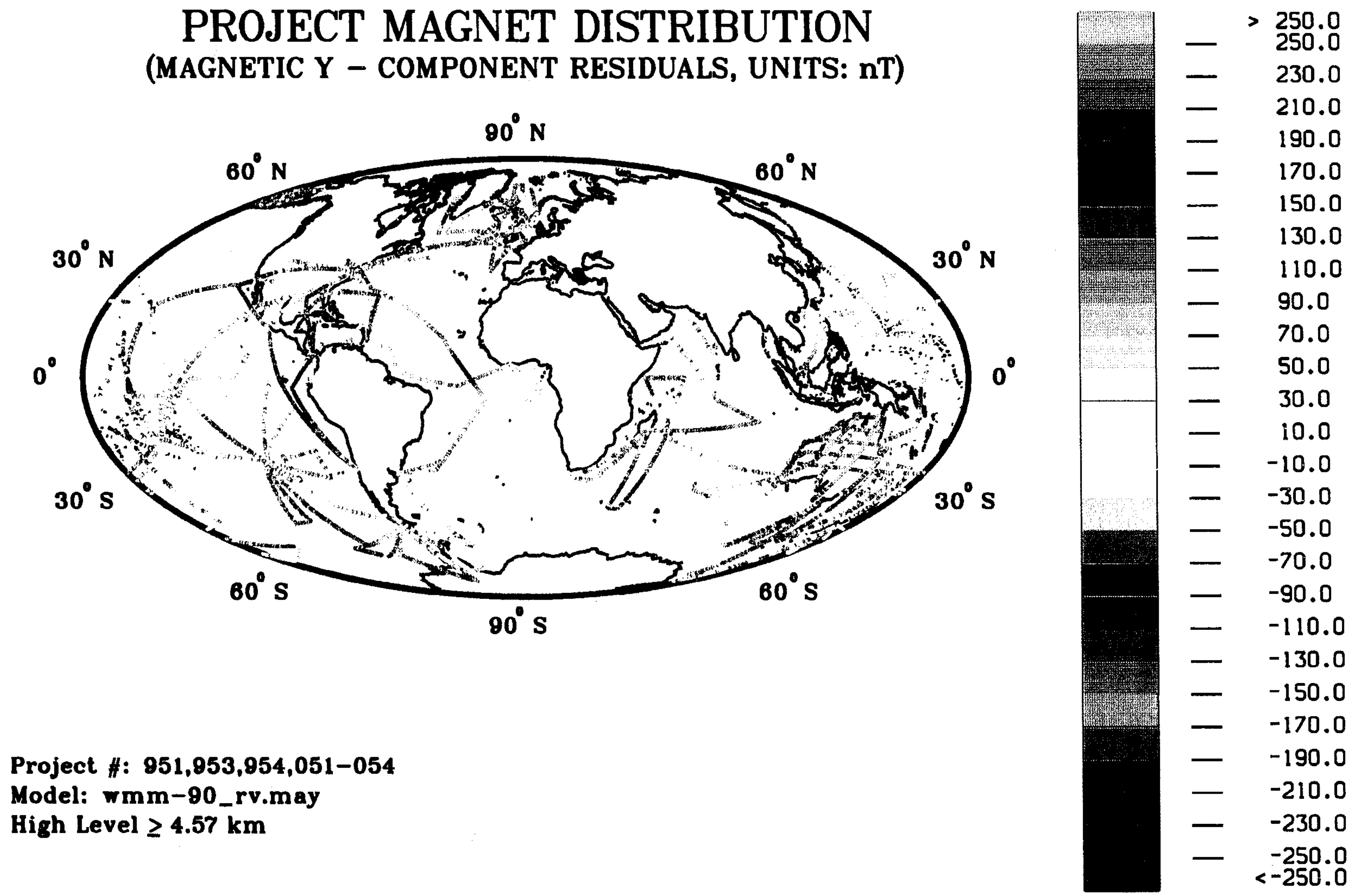


Chart 43b. C32 Project MAGNET Distribution: Y - Component Residuals

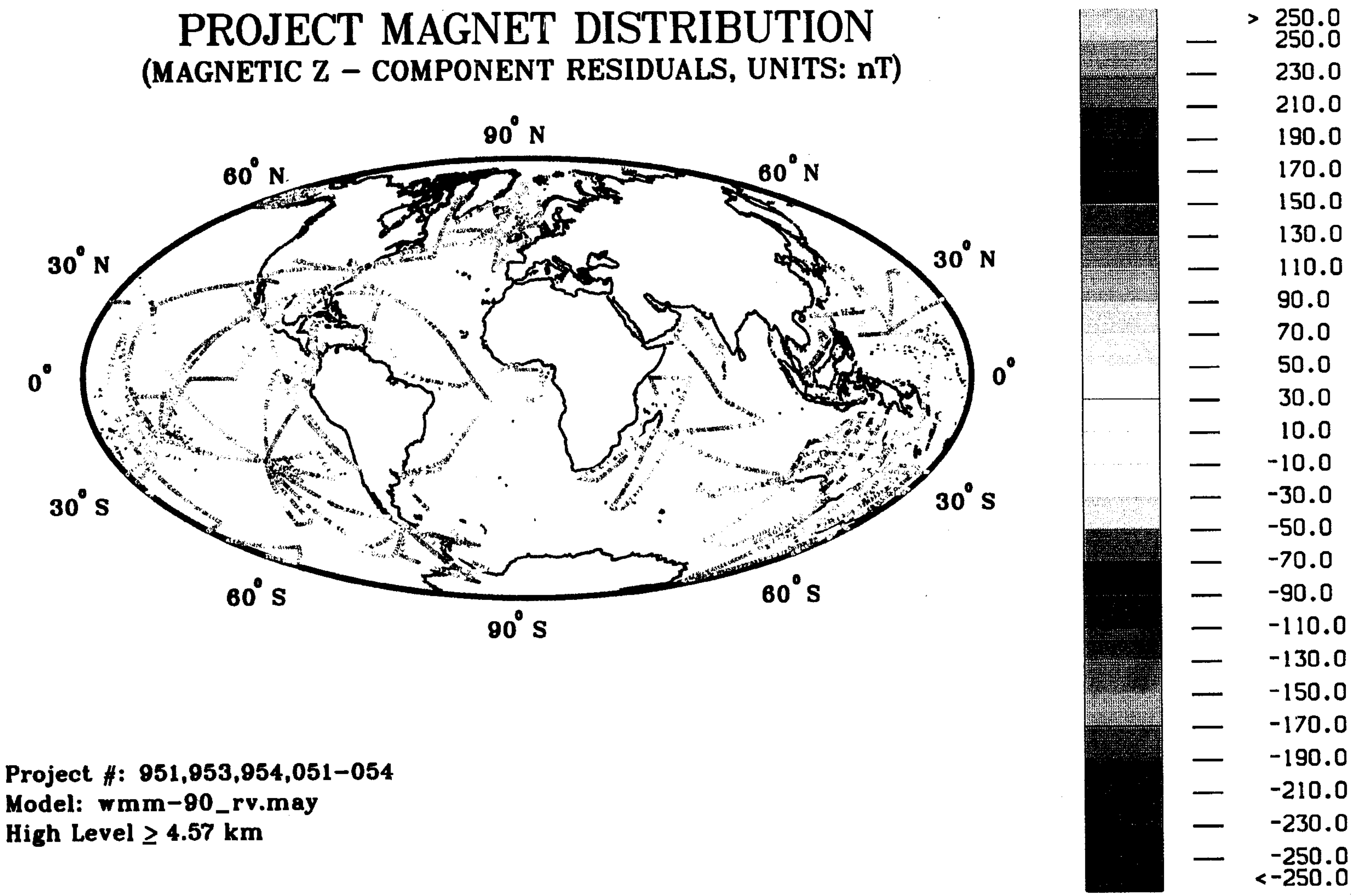


Chart 43c. C32 Project MAGNET Distribution: **Z** - Component Residuals

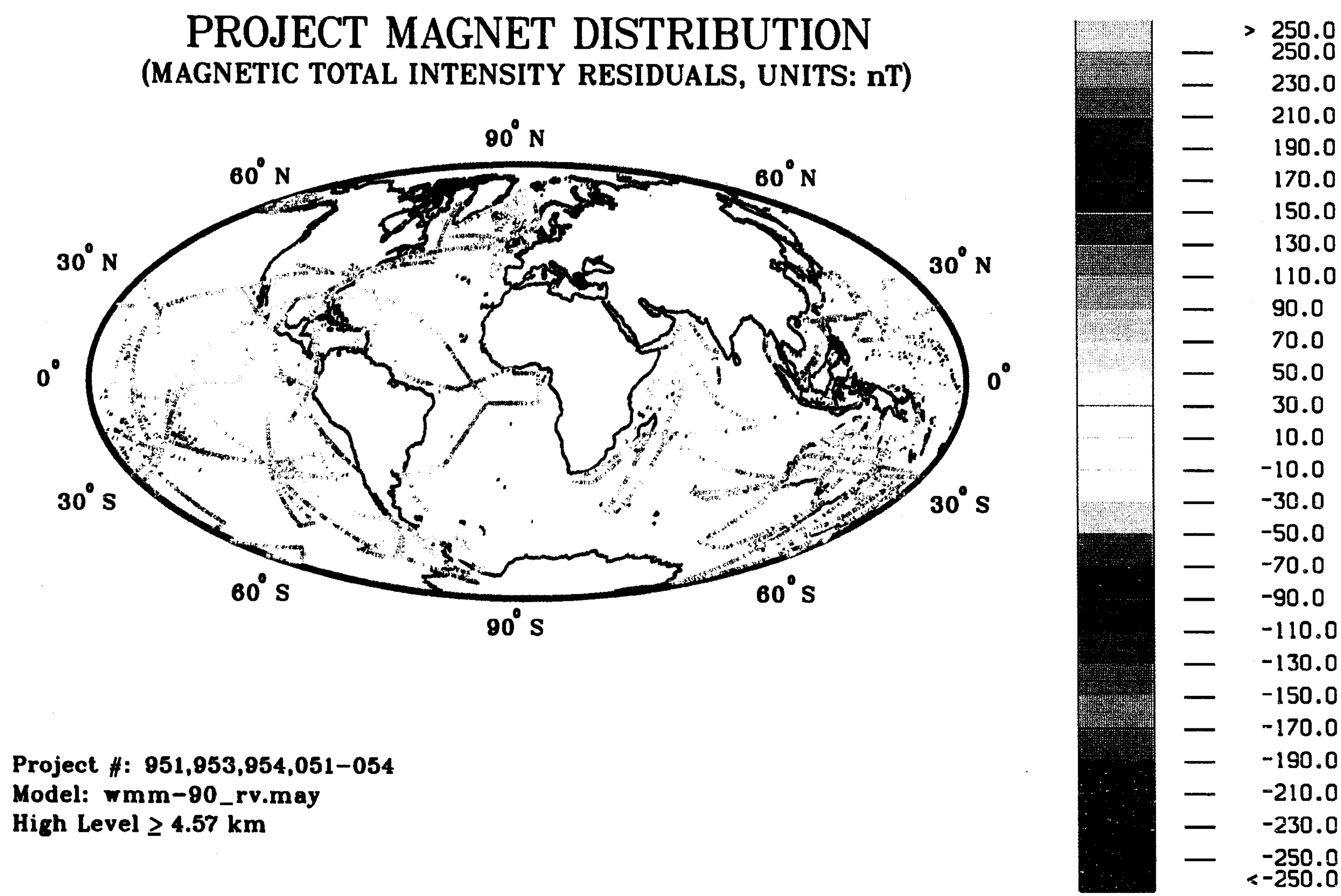


Chart 43d. C32 Project MAGNET Distribution: **F** - Component Residuals

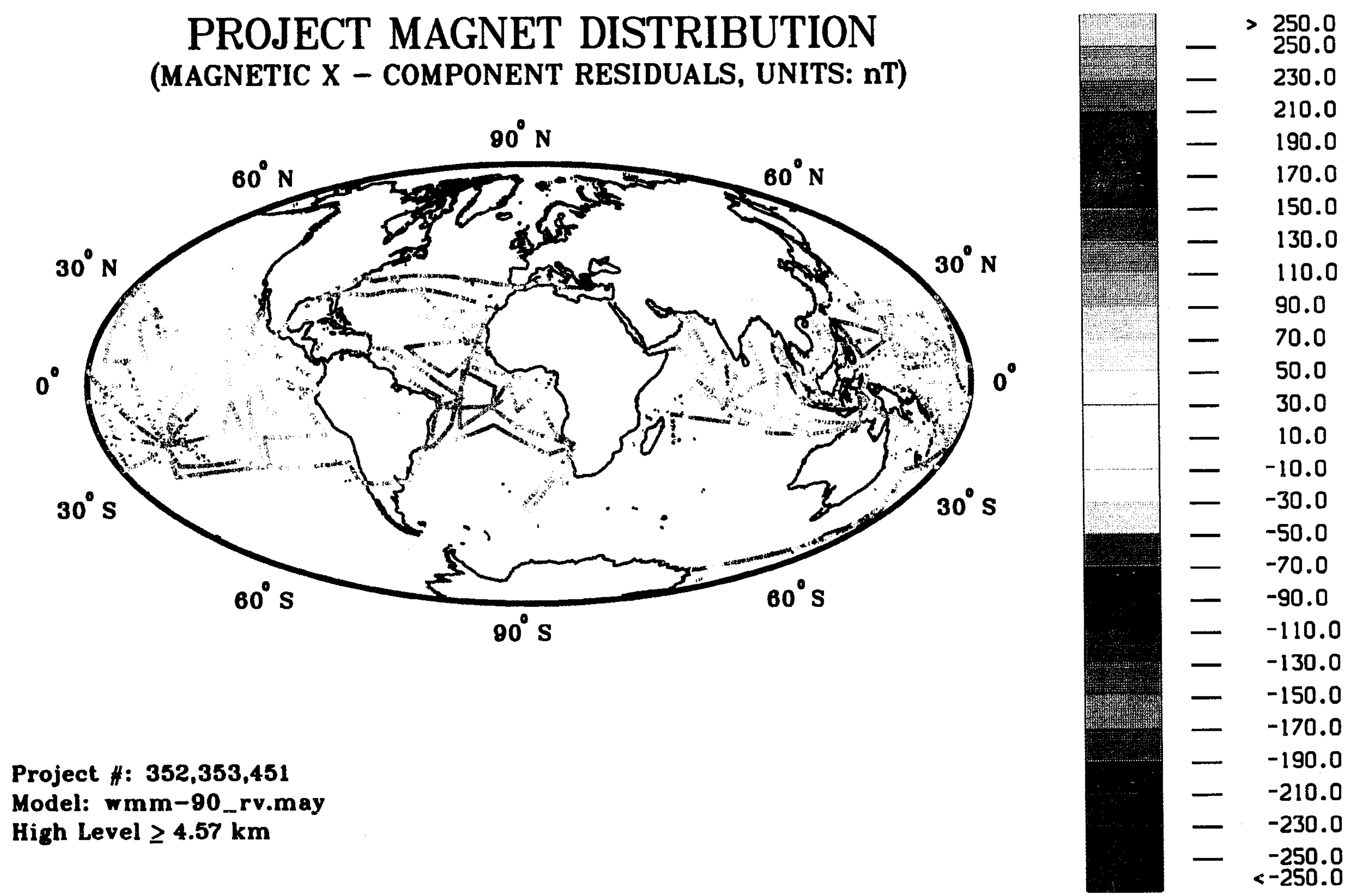


Chart 44a. D32 Project MAGNET Distribution: X - Component Residuals

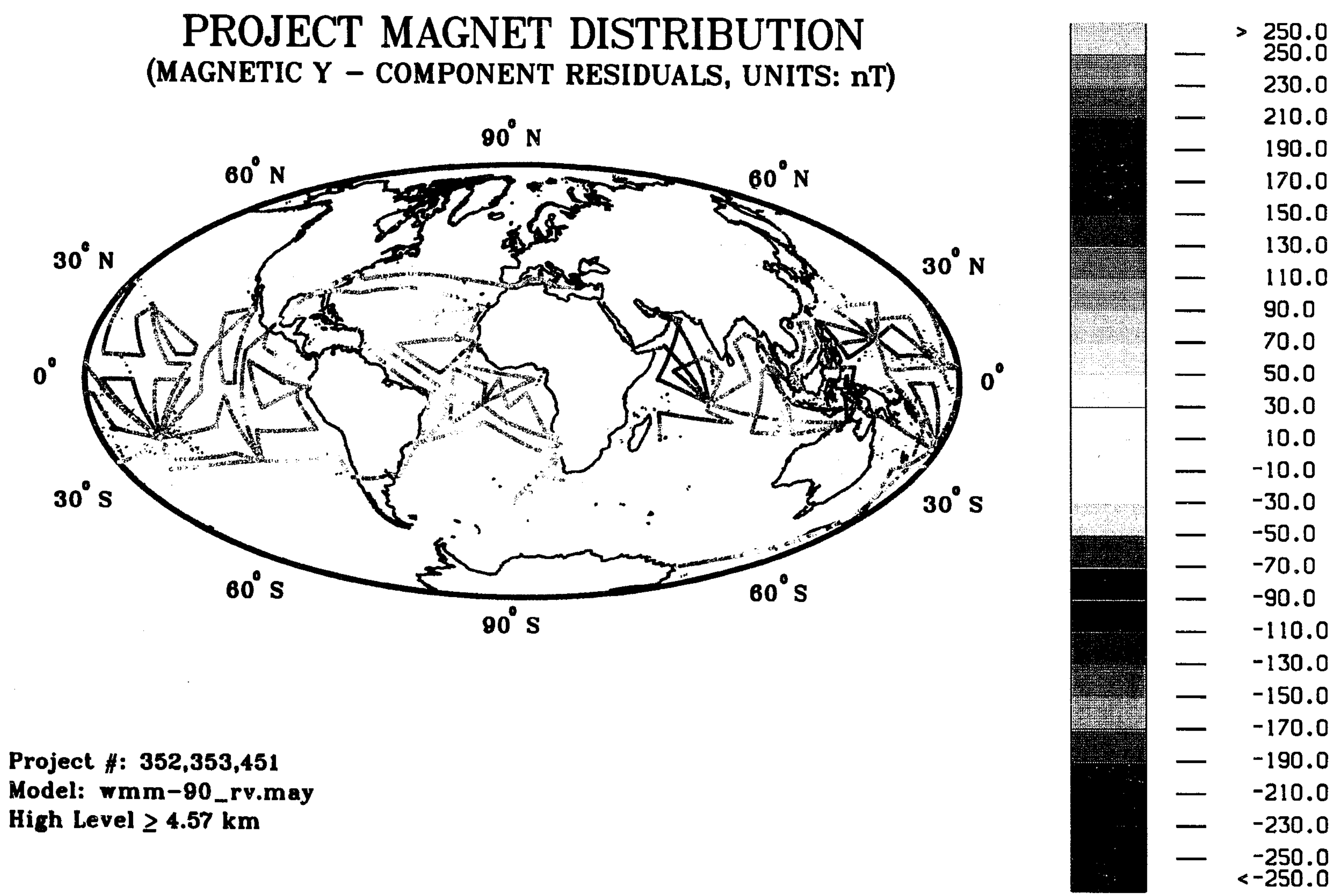


Chart 44b. D32 Project MAGNET Distribution: Y - Component Residuals

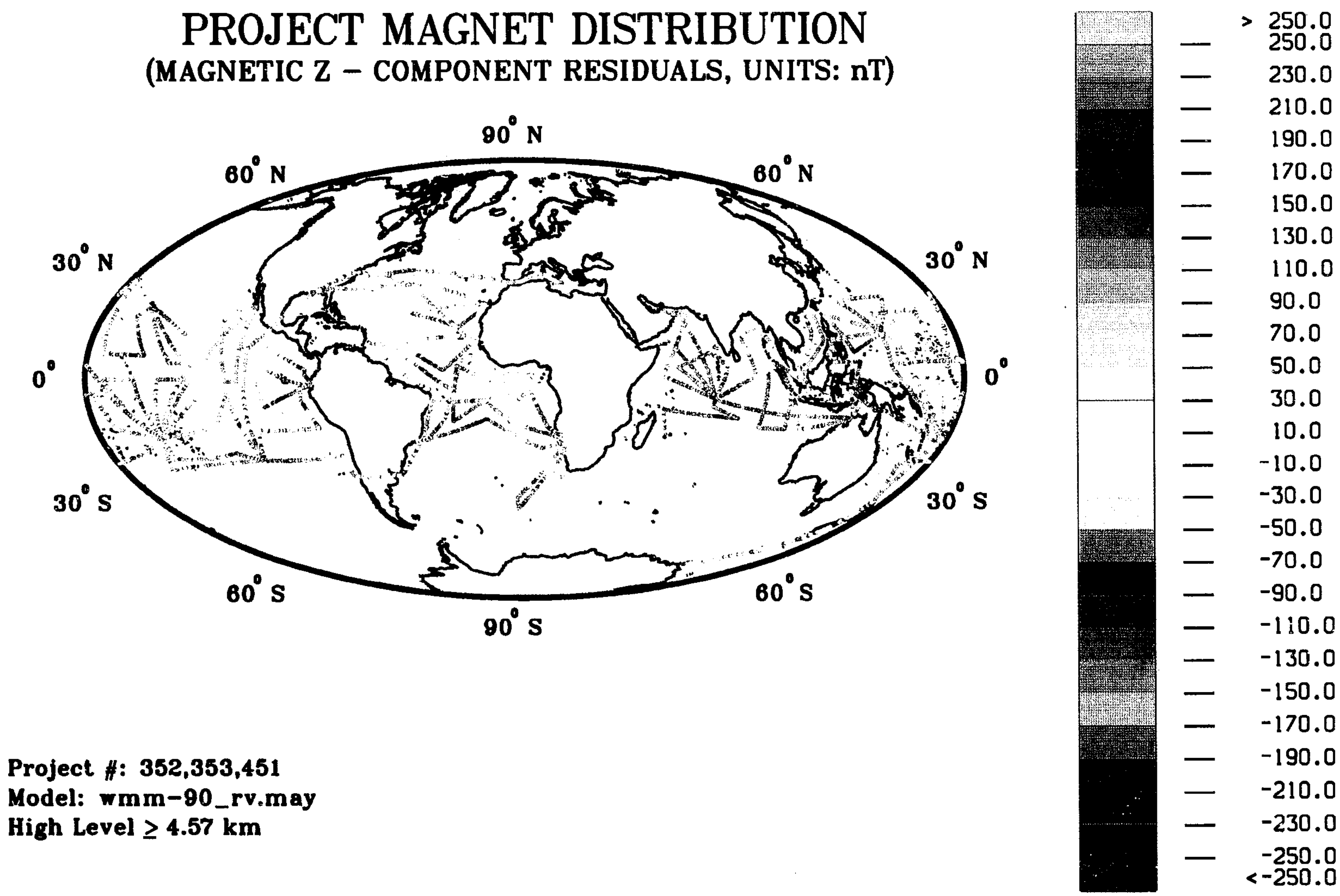


Chart 44c. D32 Project MAGNET Distribution: **Z** - Component Residuals

PROJECT MAGNET DISTRIBUTION
(MAGNETIC TOTAL INTENSITY RESIDUALS, UNITS: nT)

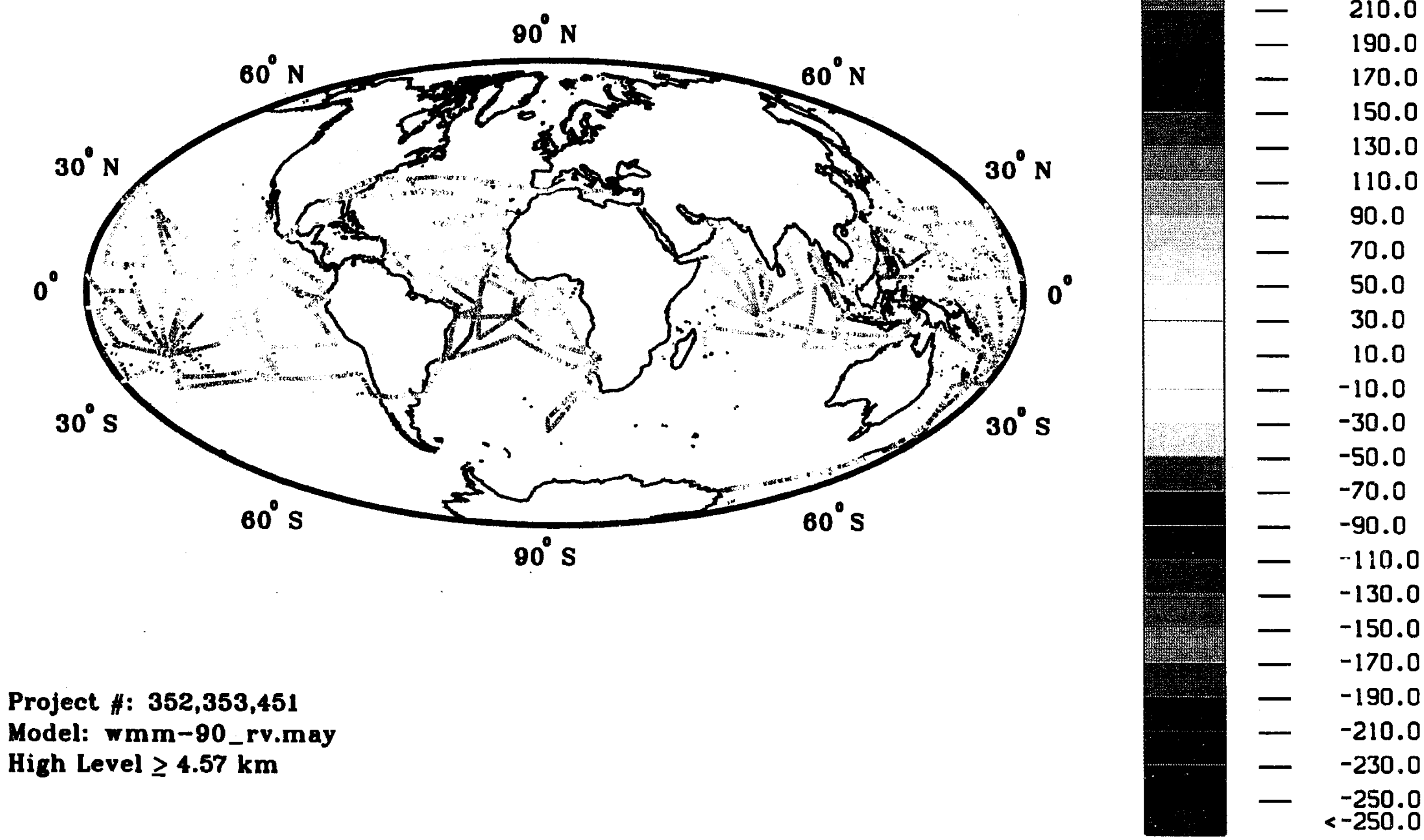


Chart 44d. D32 Project MAGNET Distribution: **F** - Component Residuals

The POGS and Project MAGNET data are available to the general public through the NGDC in Boulder, Colorado. The combined data sets are useful for both MF and SV modeling and are intended to compliment each other in the sense that vector data are required as input to the model along the magnetic equator in order to avoid *Backus effect* modeling errors (Stern and Bredekamp [1975] and Stern et al. [1980]) that would otherwise arise if only scalar Total Intensity data were available, as would be the case if POGS data alone were used.

Observatory annual-means data have been traditionally used to compute the SV portion of the WMM. The primary deficiency of this data set is its poor spatial distribution. Even when supplemented with Project MAGNET intersect data, the resulting SV models are limited to spherical-harmonic degree 8. Observatory data are not directly used for MF modeling due to the unknown crustal biases that exist under each observatory. If the Earth is divided into equal area cells on the order of 10^0 X 10^0 at the equator, then as seen in chart 45 from the BGS, roughly half of these cells contain no observatories. In this chart, cells with no observatories contain an asterisk, while those with observatories have no asterisk. A great paucity of observatory data can be seen especially in the southern hemisphere and all ocean areas in general. The status of currently operating geomagnetic observatories, of which there are only approximately 180, is discussed by McLean et al. (1994). As indicated in chart 46 (from McLean et al. [1994]) there is a significant time lag on the order of 1 to 4 years in observatory data reporting. This chart indicates the actual distribution of operating observatories as of March 1994.

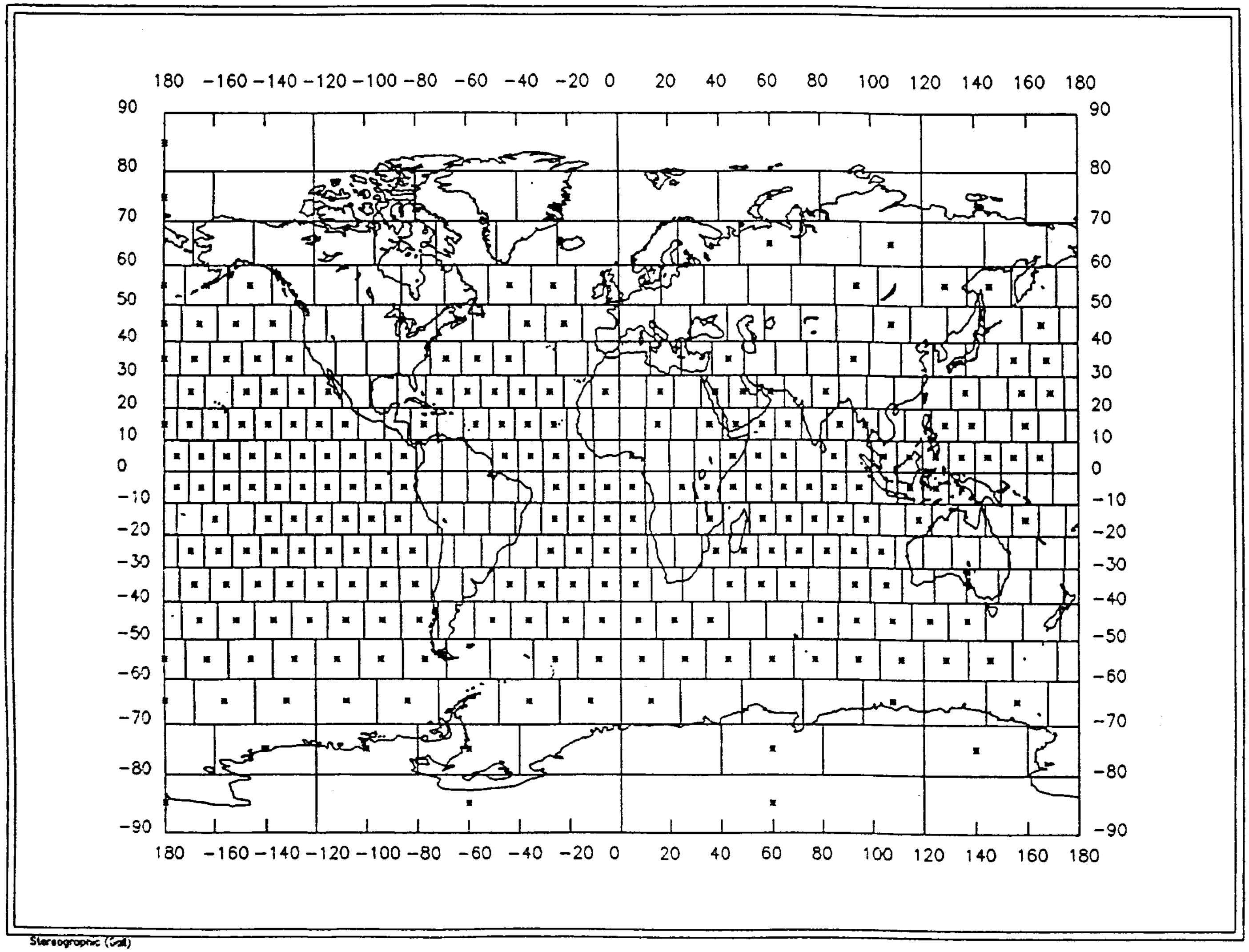
The modeling objective is to create two spherical-harmonic models. One, the MF model, characterizes the Earth's core-generated magnetic field at the 1995.0 epoch. The other, the SV model, characterizes the Earth's core-generated slow-temporal-change field for the time span from 1995.0 to 2000.0. The SV model is thus centered at 1997.5 and is referred to as the 1997.5 Epoch SV model. It is a *predictive* model since it is computed prior to 1995.0. The combined 1995.0 MF model and the 1997.5 SV model are referred to collectively as the 1995.0 Epoch World Magnetic Model. This model will expire at the end of December 1999, when another model based on new data will replace it.

Given the objective, and the available data, the following procedure was adopted:

a. Use the Observatory annual-magnetic-means data and other data as available (e.g., Project MAGNET intersect data and repeat station data) to create two Definitive SV models, the first covering the 5-year interval 1985.0 to 1990.0 and the second covering the 5-year interval 1990.0 to 1995.0. These are then referred to as the BGS *Definitive* 1987.5 and 1992.5 Epoch SV models, respectively. These were provided by the BGS using annual means data available through May 1994.

b. Use the BGS Definitive 1987.5 SV model to adjust the WC-85 (revised) model MF coefficients (Quinn et al. [1991]) to the 1990.0 Epoch. The resulting MF model, when merged with the BGS Definitive 1992.5 Epoch SV model is designated as the WMM-90 (modified) model. This model is considered to be the best *a priori* model estimate for the 1990 to 1995 time span.

The 239 10 degree tesserae (out of a maximum of 412) filled with SV values from WMM97P.

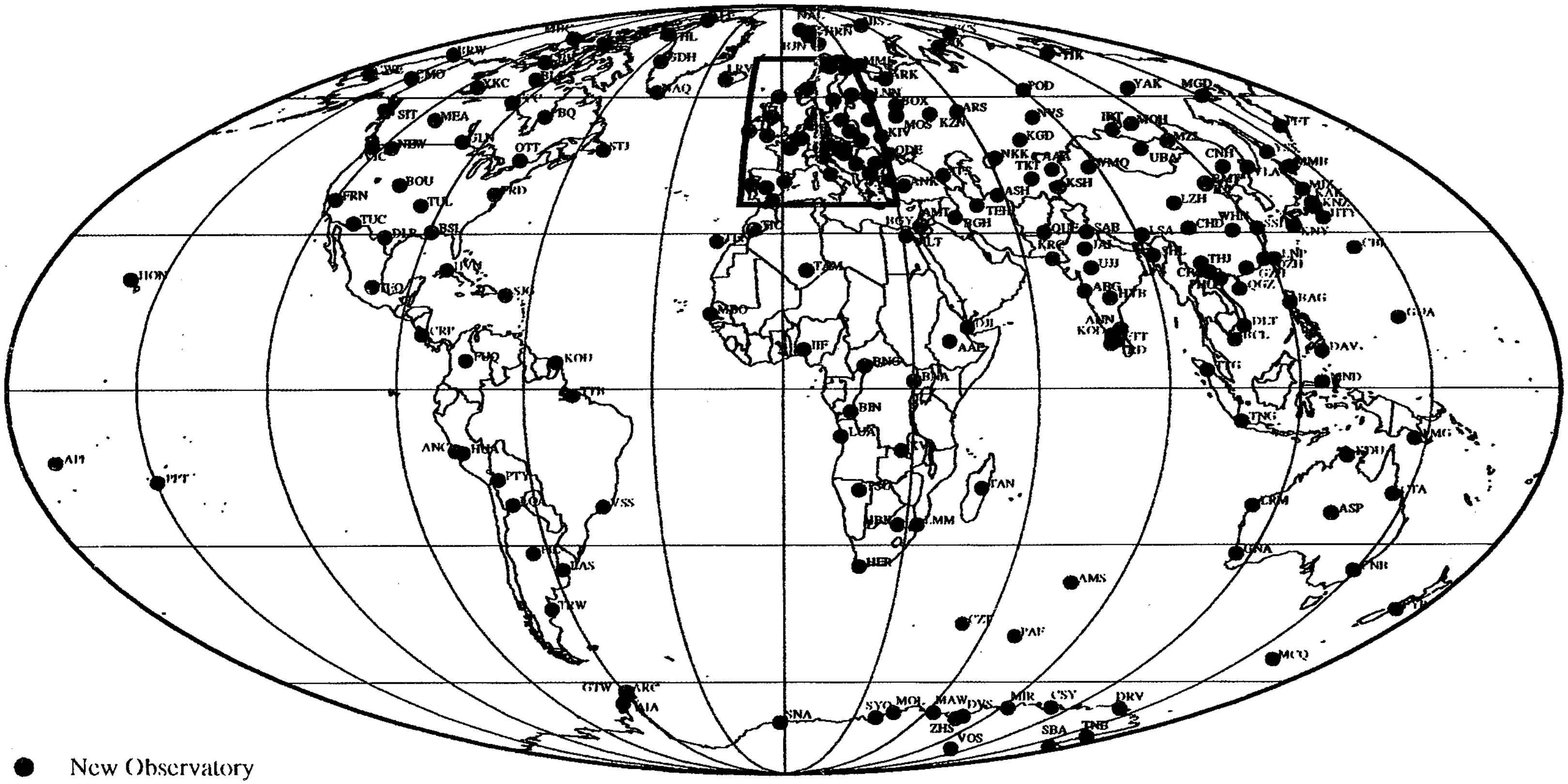


Courtesy of British Geological Survey (BGS), September 1994

Chart 45. BGS 10^0 X 10^0 Equal Area Geomagnetic Observatory Distribution

Magnetic Observatories in Operation 1994

(based on data received at the WDC-A)



- New Observatory
- Observatory Annual Means for 1992 or Later at WDC-A
- Observatory Annual Means for 1990 or 1991 at WDC-A
- Observatory Operation Uncertain or Annual Means for 1989 or Earlier

Chart 46. NGDC Geomagnetic Observatory Distribution & Reporting History

c. Select POGS data on the basis of the Kp and Dst indices and according to local time in accordance with the criteria stated above for each 10-day file.

d. Locate consecutive groups of 10-day POGS select files from which the total data selected consisted of approximately 18,000 uniformly distributed records and for which a maximum of six 10-day files was used. A total of 14 time groups satisfying these criteria were identified. Some, corresponding to magnetically very quiet times, contained just two 10-day files, while others, corresponding to less quiet times, contained the maximum of six 10-day files. Some groups overlapped, while other groups were separated significantly in time.

e. Make preliminary MF models for each of the 14 POGS defined time groups at their respective mean epochs and use these models to isolate the majority of the ionospheric magnetic field and to devise a *Magnetic Latitude dependent Ionospheric Correction* for each 10-day POGS select file.

f. Select from each ionospherically corrected 10-day file for all 14 time groups, that portion of the data which passes over Europe, where the WMM-90 (modified) model is expected to be the most accurate due to the large concentration of geomagnetic observatories in that region. This *select* European data subset covers the approximate time from 1991 through 1993.7. Then use the POGS scalar magnetic residuals, computed with respect to the WMM-90 (modified) model, to compute the POGS magnetometer Total Intensity *Bias* and *Drift-Rate* via least squares, assuming a linear drift.

g. Apply the *Bias* and *Drift-Rate* corrections and the ionospheric corrections to the 10-day POGS select files in each of the 14 time groups.

h. Adjust the entire Project MAGNET data set to the mean epoch of each of the 14 POGS-defined time groups, using the WMM-90 (modified) model.

i. Make MF models at each of the 14 group epochs.

j. Perform a least-squares fit over the 14 epochs for each MF Gauss coefficient using 1992.5 as a reference time. A 1992.5 Epoch MF model results, along with a 1992.5 SV model designated as SV 1992.5 (A). Combined, two coefficient sets are referred to as the WMM-92.5 (optimum) model. Both the MF and SV portions of this model are completely defined through degree and order 12. An alternate procedure, independent of the POGS data and involving observatory data and Project MAGNET intersect data, generated another 1992.5 SV model designated as SV 1992.5 (B). It is defined only through degree and order 8 due to the poor distribution of these two data sets.

k. Use the SV portion of the WMM-92.5 (*optimum*) model to adjust the MF d portion of the WMM-92.5 (*optimum*) model backward 2.5 years to 1990.0. Then merge the SV portion of the WMM-92.5 (*optimum*) model with this new adjusted 1990.0 Epoch MF model to form the WMM-90 (*revised*) model. Subsequently adjust the WMM-90 (*revised*) MF model forward to the 1995.0 Epoch using the average of the SV 1992.5 (A) and SV 1992.5 (B) models truncated to degree 8. The result is the WMM-95 MF model.

l. Use Magnetic Observatory and Project MAGNET survey-track intersect data, filling in remaining spatial gaps with SV values generated from the WMM-90 (revised) model of step "j" where necessary, to generate a 1997.5 Predictive SV model.

m. Combine the 1995.0 Epoch MF model generated in step "j" with the 1997.5 Epoch Predictive SV model of step "l" to obtain the WMM-95 model.

The WMM-90 (revised) model is a by-product of the WMM-95 modeling process. When truncated to degree 10, it becomes a candidate model for the 1990.0 Epoch Definitive Geomagnetic Reference Field (DGRF-90) model of the IAGA, while the WMM-95 model, when truncated to degree 10, becomes a candidate model for the International Geomagnetic Reference Field (IGRF-95) model of IAGA.

The four SV models discussed above are listed in table 4. Three of these SV models (i.e., 1987.5, 1992.5(B), and 1997.5) were generated by BGS, using the techniques described by Macmillan (1994). The Gauss coefficients for all of these models are based on Observatory annual means data, Repeat Station data, and Project MAGNET intersect data and so are necessarily truncated to degree and order 8.

2.1 Secular-Variation Data Analysis

Traditionally, the most accurate data available for SV modeling have been Quiet-Day observatory magnetic-annual-means, the first time-derivative of which provides information concerning the slow rates of change (greater than one year) of various components of the Earth's Main magnetic field at various locations (roughly 180) scattered around the world. Due to the sparsity and spatial nonuniformity of this data set, it is possible to generate only a degree and order 8 spherical-harmonic SV model, even when these data are supplemented with other data such as Project MAGNET intersect difference data and Repeat Station data, since these supplementary data are also sparse, nonuniformly distributed and generally less accurate than the annual means data. Furthermore, the Predictive SV model is necessarily based on *extrapolations* of observatory annual means at each observatory site. The BGS has been primarily responsible for generating the Predictive SV portion of the WMM series of magnetic models as was the case for this 1995.0 Epoch.

Examples of observatory annual means data from a few selected sites (Honolulu, Huancayo, Pilar, and Rude Skov) for the **X**-north, **Y**-east, and **Z**-vertically down components of the Earth's magnetic field, as well as for the **D**-Declination, **I**-Inclination, and **F**-Total Intensity components of the Earth's magnetic field, are given in figures 1a, 1b, 1c, 1d, 1e, and 1f through 4a, 4b, 4c, 4d, 4e, and 4f. The discontinuities in the field components at Honolulu are due to the repositioning of the observatory at two different instances. The geographic location and elevation of these observatories are given in the legend in the upper left-hand corner of these figures. Notice that the rate of change of one or more of the field components at several observatory sites has reversed direction over time intervals as short as 2 or 3 years. This behavior is an illustration of the sudden, unpredictable nature of the Earth's core magnetic field

Table 4. BGS Definitive and Predictive SV Model Coefficients (units: nanoteslas/year)

		1987.5		1992.5 (A)		1992.5 (B)		1997.5	
n	m	$\dot{g}_n^m$	$\dot{h}_n^m$	$\dot{g}_n^m$	$\dot{h}_n^m$	$\dot{g}_n^m$	$\dot{h}_n^m$	$\dot{g}_n^m$	$\dot{h}_n^m$
1	0	19.3	0.0	19.1	0.0	18.8	0.0	17.6	0.0
1	1	11.2	-17.9	12.5	-17.9	13.0	-17.8	13.2	-18.0
2	0	-12.6	0.0	-13.4	0.0	-13.4	0.0	-13.7	0.0
2	1	2.9	-16.1	3.6	-14.9	3.7	-15.3	4.0	-14.6
2	2	0.3	-13.8	-0.1	-9.5	-0.5	-8.8	-0.3	-7.2
3	0	3.8	0.0	1.8	0.0	1.8	0.0	0.8	0.0
3	1	-6.7	4.2	-7.0	4.1	-6.8	3.7	-6.6	4.0
3	2	-0.4	1.9	-0.6	1.9	-0.6	2.0	-0.5	2.2
3	3	-5.1	-10.6	-7.9	-12.0	-7.7	-12.2	-8.5	-12.6
4	0	0.4	0.0	0.8	0.0	1.1	0.0	1.2	0.0
4	1	0.3	3.1	0.7	2.0	0.7	2.0	1.1	1.3
4	2	-7.3	2.0	-6.7	1.4	-6.9	1.3	-6.8	1.0
4	3	0.4	3.5	0.6	2.8	0.3	2.9	0.3	2.5
4	4	-5.9	-0.6	-5.5	-1.3	-5.1	-1.2	-4.5	-1.2
5	0	0.1	0.0	0.6	0.0	0.6	0.0	0.9	0.0
5	1	-0.2	0.1	0.0	0.2	0.2	0.3	0.5	0.5
5	2	-1.5	0.8	-1.1	0.9	-1.5	0.9	-1.4	1.5
5	3	-3.5	-0.3	-2.4	0.6	-2.4	0.4	-1.7	0.6
5	4	0.0	1.5	0.3	1.9	-0.1	1.8	0.0	1.7
5	5	1.8	0.8	2.5	1.0	2.1	0.9	2.1	0.6
6	0	2.0	0.0	1.2	0.0	1.0	0.0	0.4	0.0
6	1	0.0	0.0	0.0	0.3	0.0	0.4	-0.3	0.7
6	2	1.6	-1.2	0.9	-1.4	0.7	-1.3	0.3	-1.5
6	3	1.3	0.1	1.8	-0.2	2.1	-0.3	2.1	-0.5
6	4	-0.3	-1.1	-0.3	-0.6	-0.2	-0.8	0.0	-0.7
6	5	0.1	0.5	-0.2	0.8	-0.3	0.8	-0.4	1.1
6	6	1.4	0.9	0.4	2.0	0.1	1.9	-0.4	2.6
7	0	0.6	0.0	0.1	0.0	-0.1	0.0	-0.3	0.0
7	1	-0.7	0.6	-0.9	0.5	-0.9	0.5	-1.1	0.3
7	2	-0.1	0.2	-0.6	0.3	-0.6	0.3	-0.5	0.0
7	3	0.9	0.7	0.6	0.5	0.6	0.7	0.5	0.7
7	4	1.4	-0.1	0.9	-0.4	1.4	-0.3	1.3	-0.6
7	5	0.6	-0.3	0.5	0.0	0.6	0.0	0.1	0.1
7	6	0.0	0.2	0.1	-0.1	0.0	-0.2	0.0	-0.6
7	7	-0.1	-0.3	-0.7	-0.7	-0.7	-0.5	-0.9	-0.4
8	0	0.0	0.0	0.0	0.0	0.3	0.0	0.1	0.0
8	1	-0.4	0.6	-0.4	0.5	-0.3	0.4	0.0	0.4
8	2	-0.3	-0.2	-0.1	0.0	0.0	-0.3	0.4	-0.3
8	3	0.3	0.3	0.2	0.2	0.2	0.2	0.3	0.1
8	4	-0.6	0.4	-0.8	0.5	-1.0	0.7	-1.3	0.8
8	5	-0.1	0.1	0.0	-0.1	0.2	0.0	0.5	-0.1
8	6	-0.2	-0.8	0.0	-1.3	0.2	-1.0	0.4	-1.3
8	7	-0.5	-0.6	-0.7	-0.2	-0.9	-0.6	-0.9	-0.9
8	8	-0.2	0.7	-0.3	0.0	-0.3	-0.7	0.1	-1.1

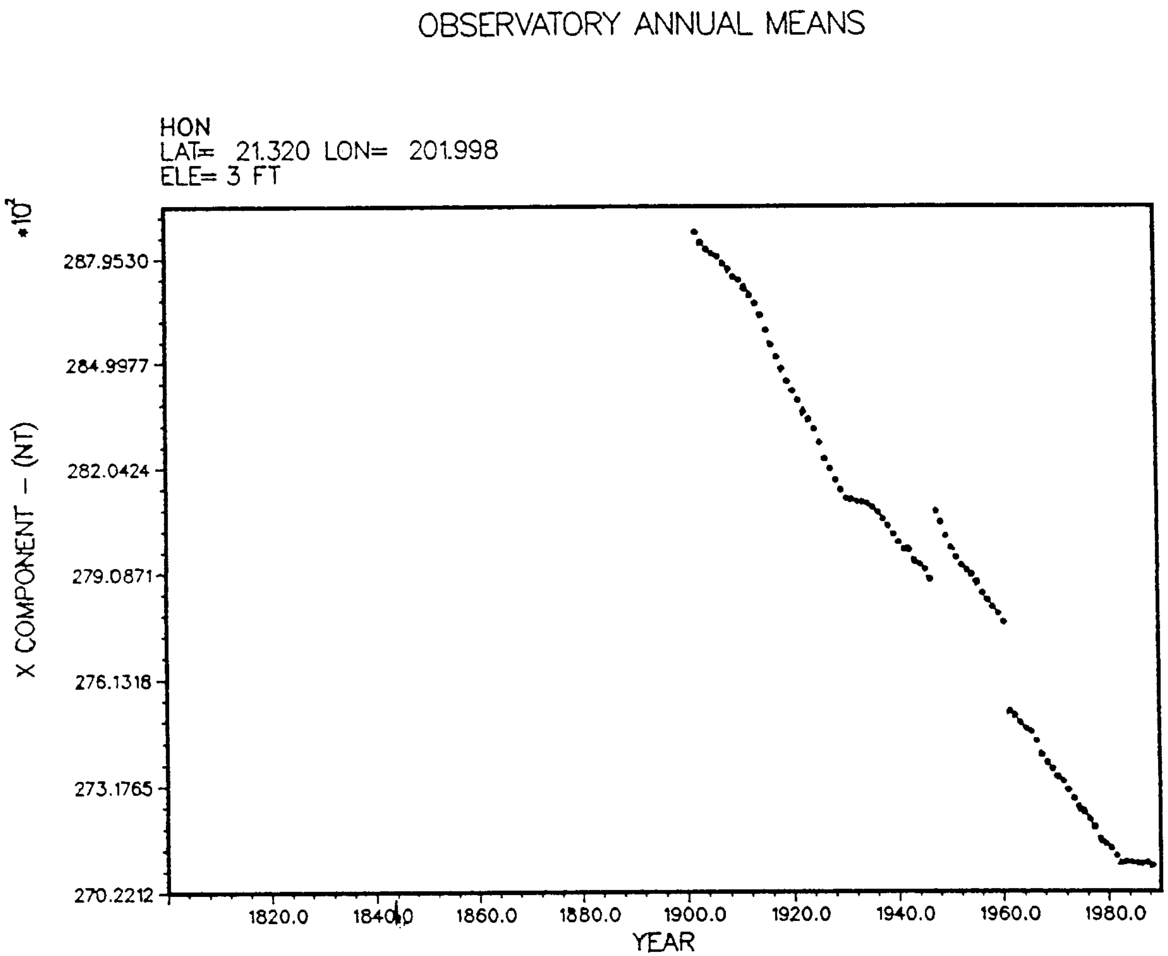


Figure 1a. North **X** Component at Honolulu (HON)

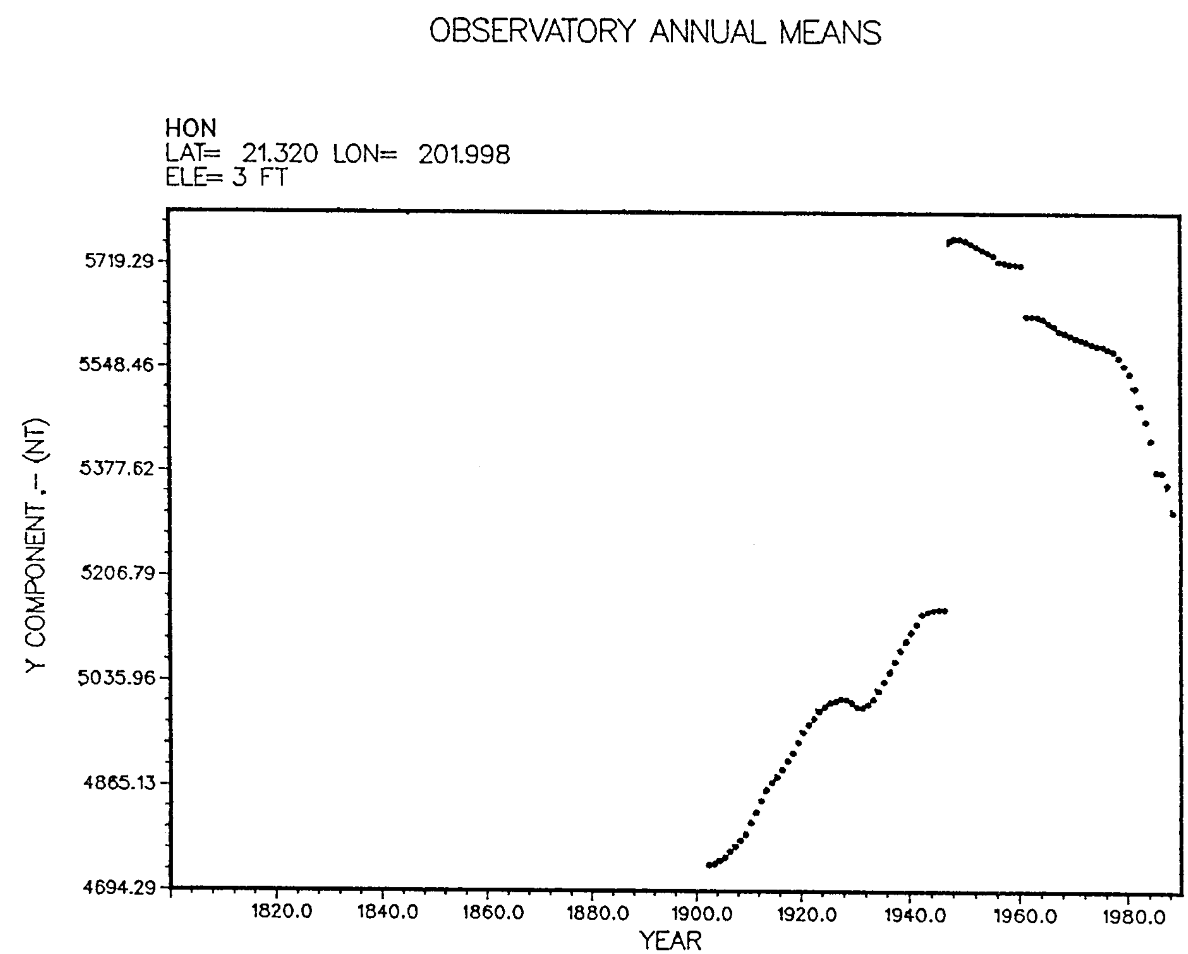


Figure 1b. East **Y** Component at Honolulu (HON)

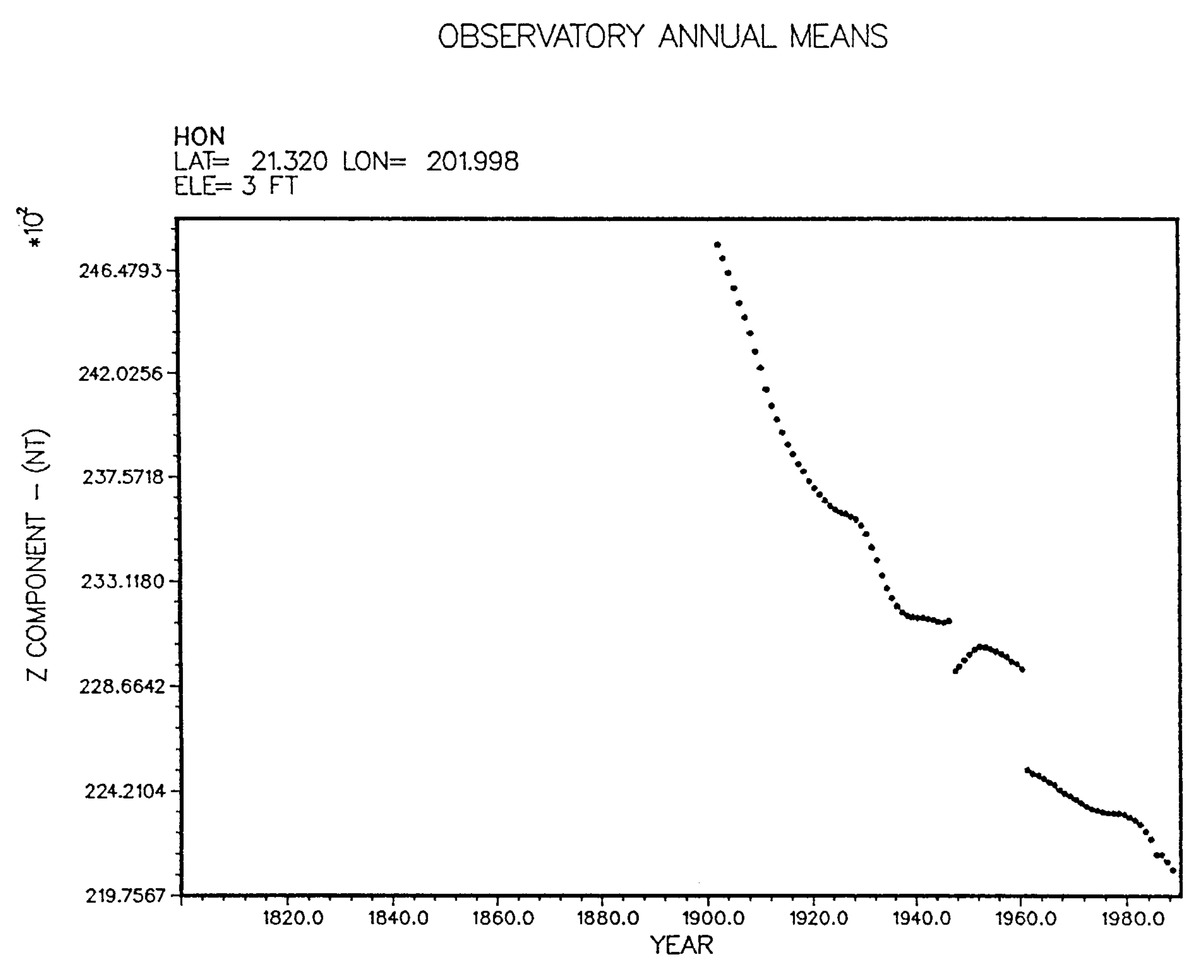


Figure 1c. Vertical **Z** Component at Honolulu (HON)

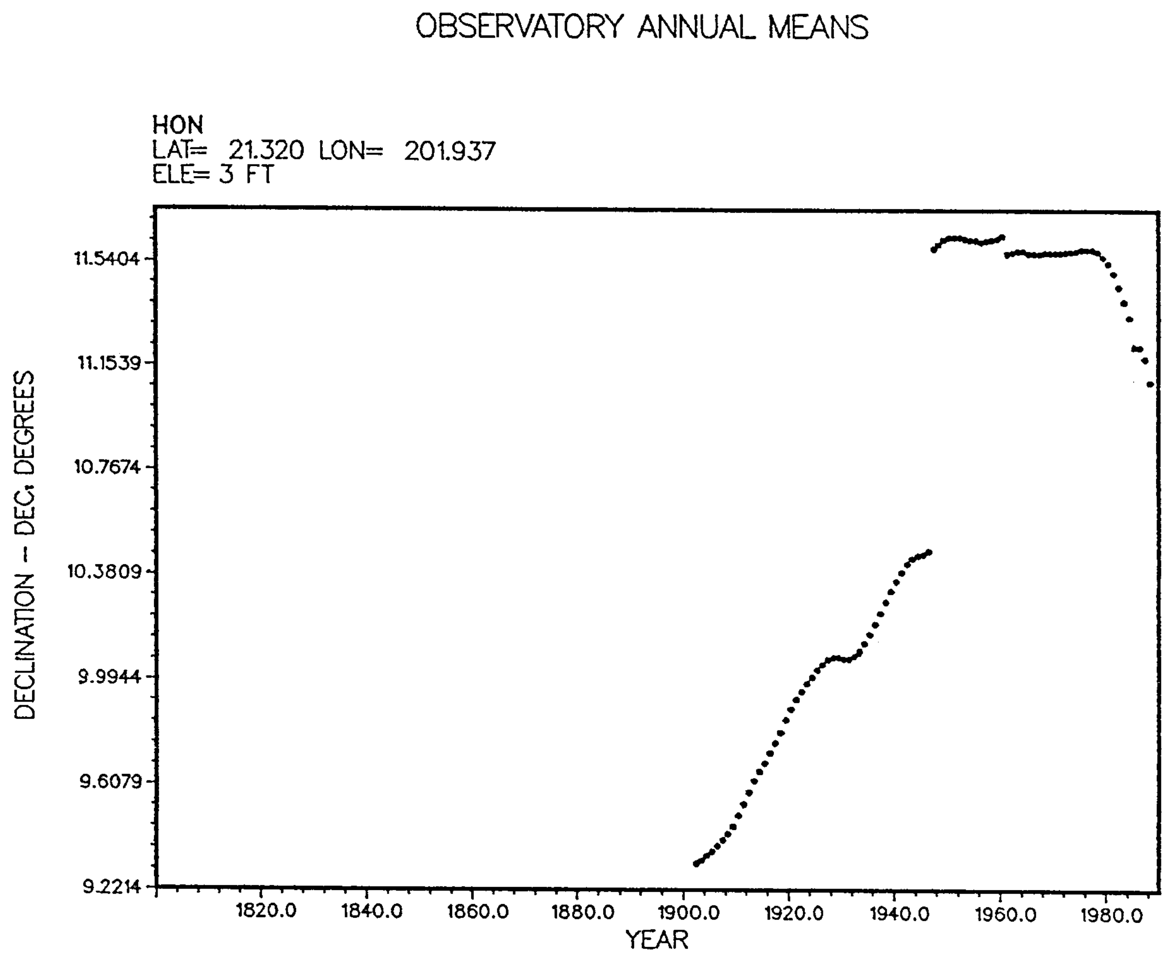


Figure 1d. Declination **D** Component at Honolulu (HON)

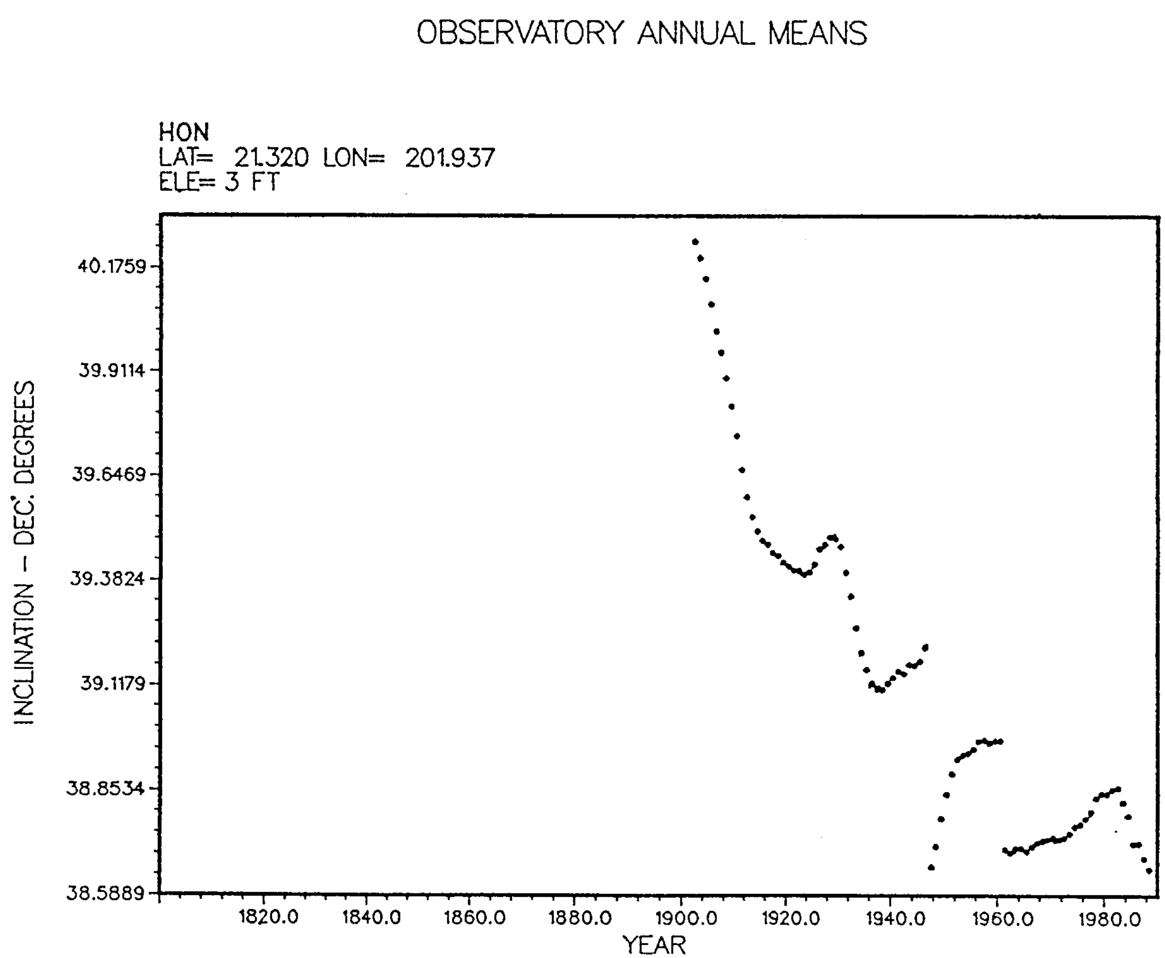


Figure 1e. Inclination **I** Component at Honolulu (HON)

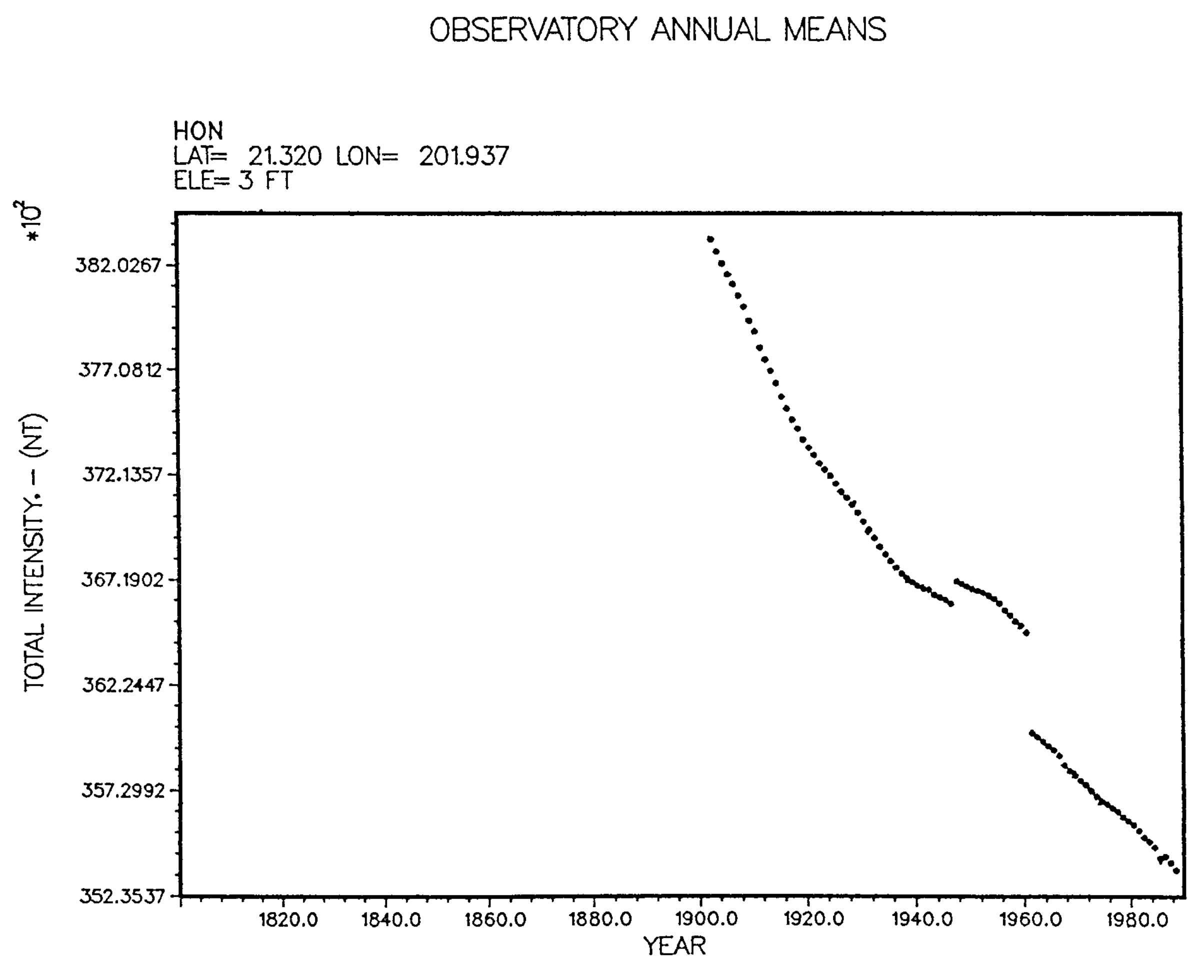


Figure 1f. Total Intensity **F** Component at Honolulu (HON)

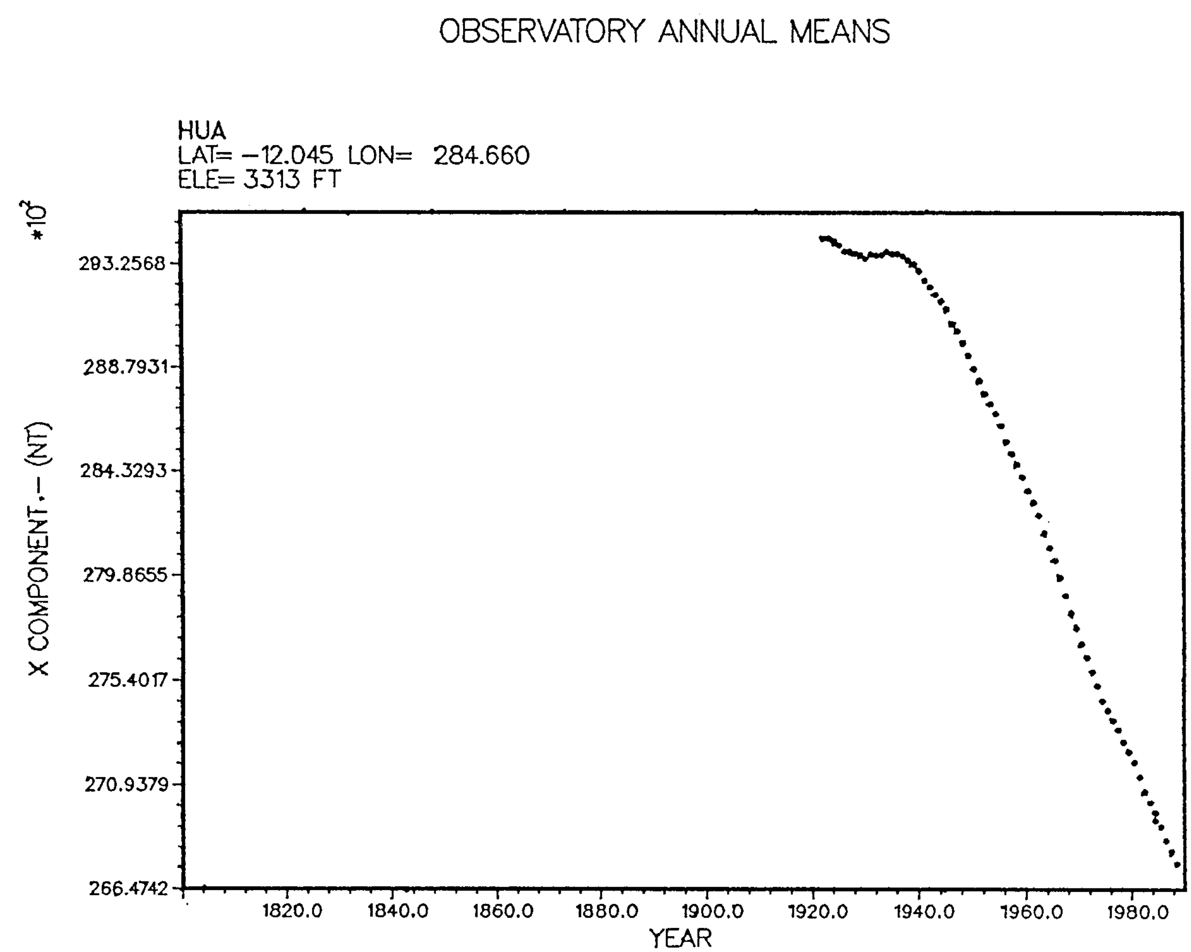


Figure 2a. North **X** Component at Huancayo (HUA)

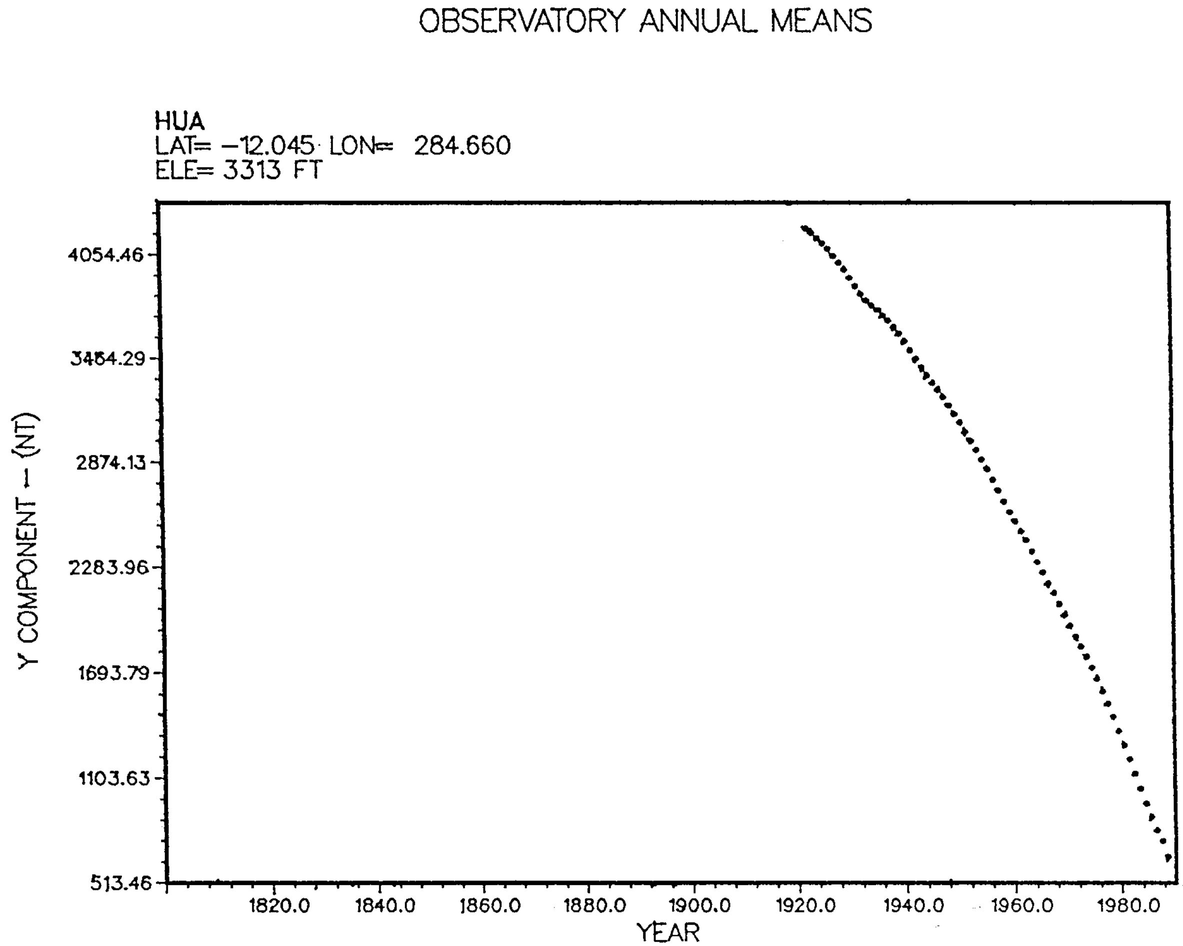


Figure 2b. East **Y** Component at Huancayo (HUA)

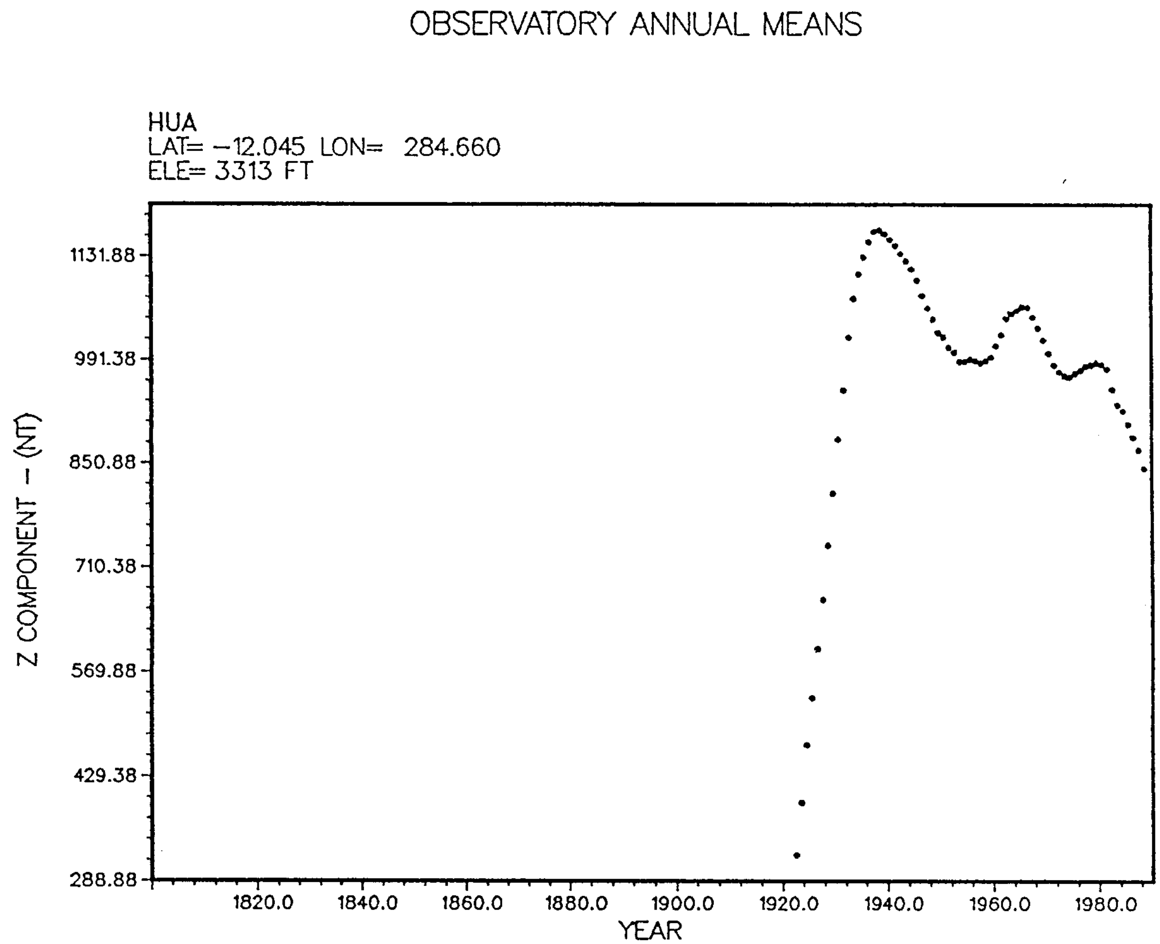


Figure 2c. Vertical **Z** Component at Huancayo (HUA)

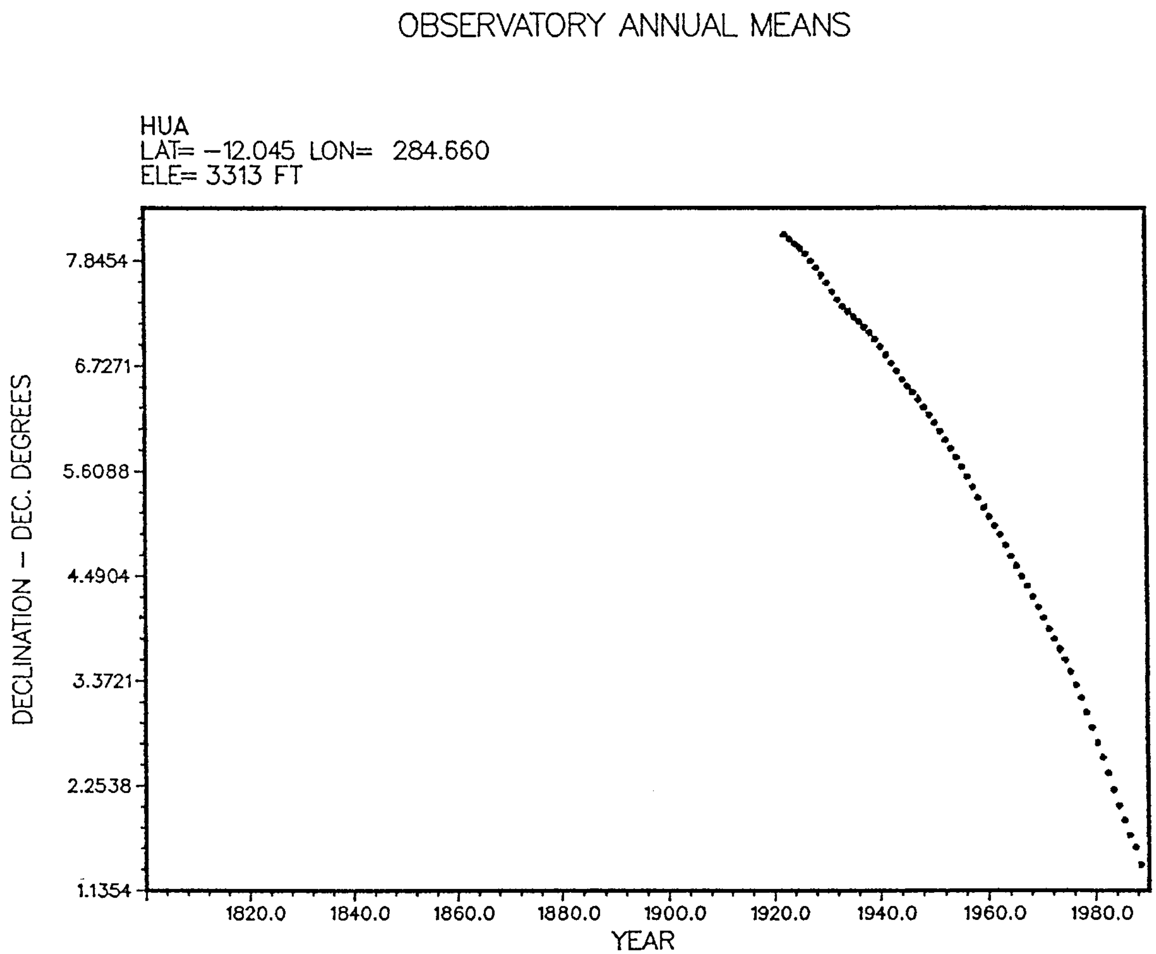


Figure 2d. Declination **D** Component at Huancayo (HUA)

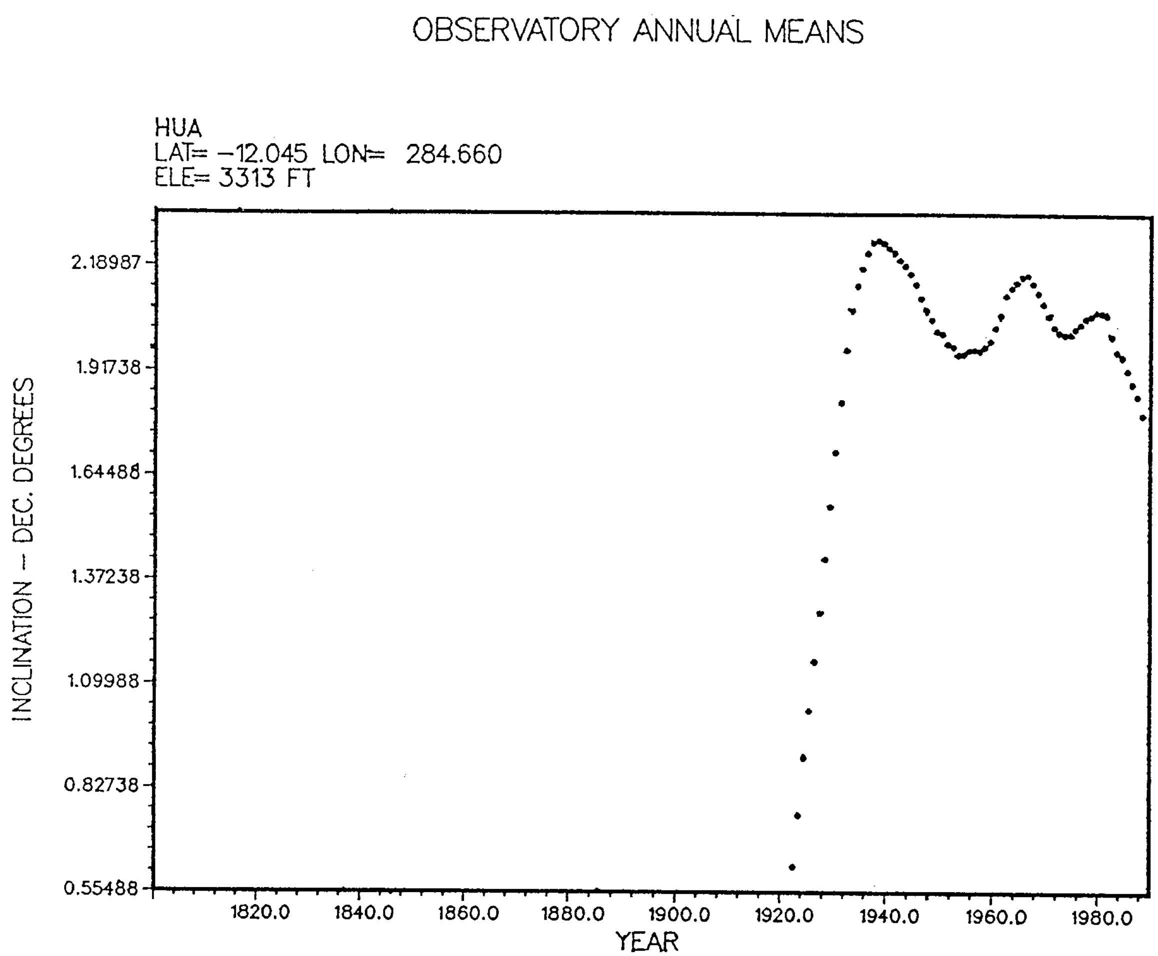


Figure 2e. Inclination **I** Component at Huancayo (HUA)

OBSERVATORY ANNUAL MEANS

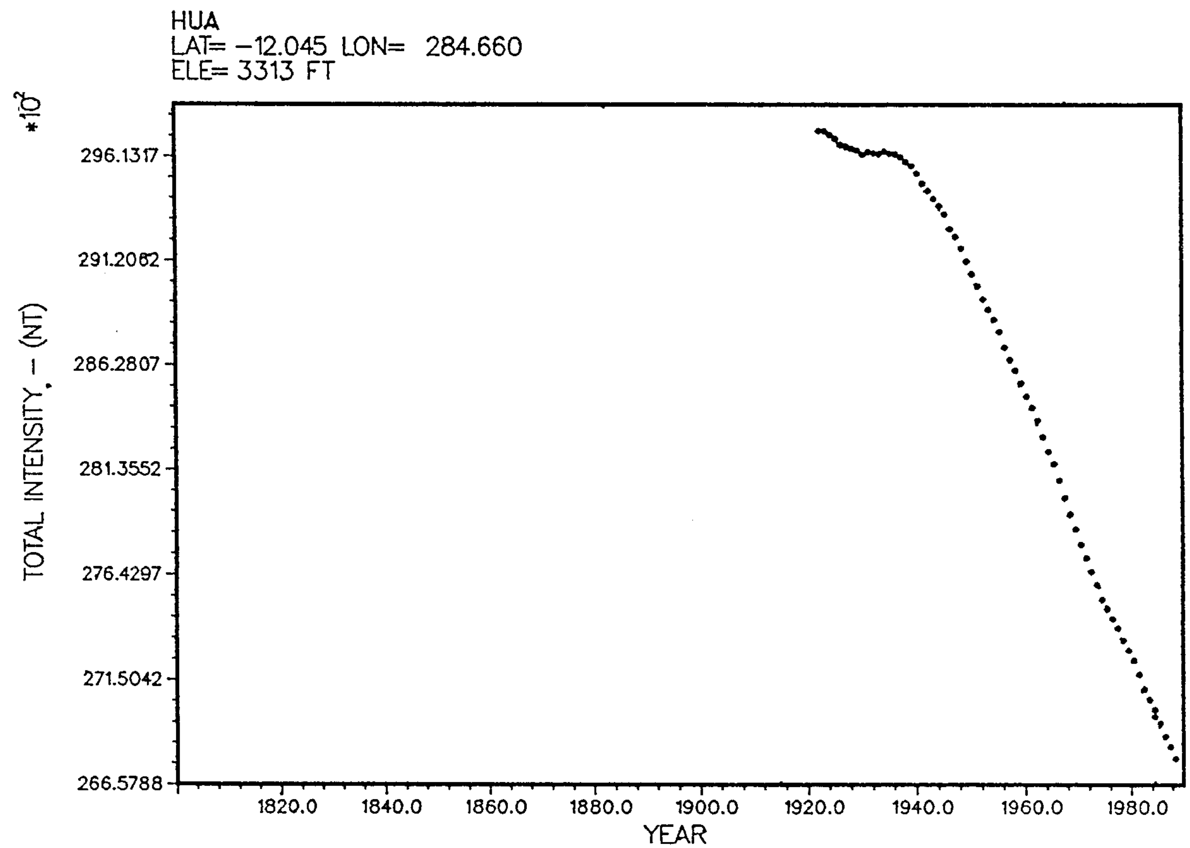


Figure 2f. Total Intensity **F** Component at Huancayo (HUA)

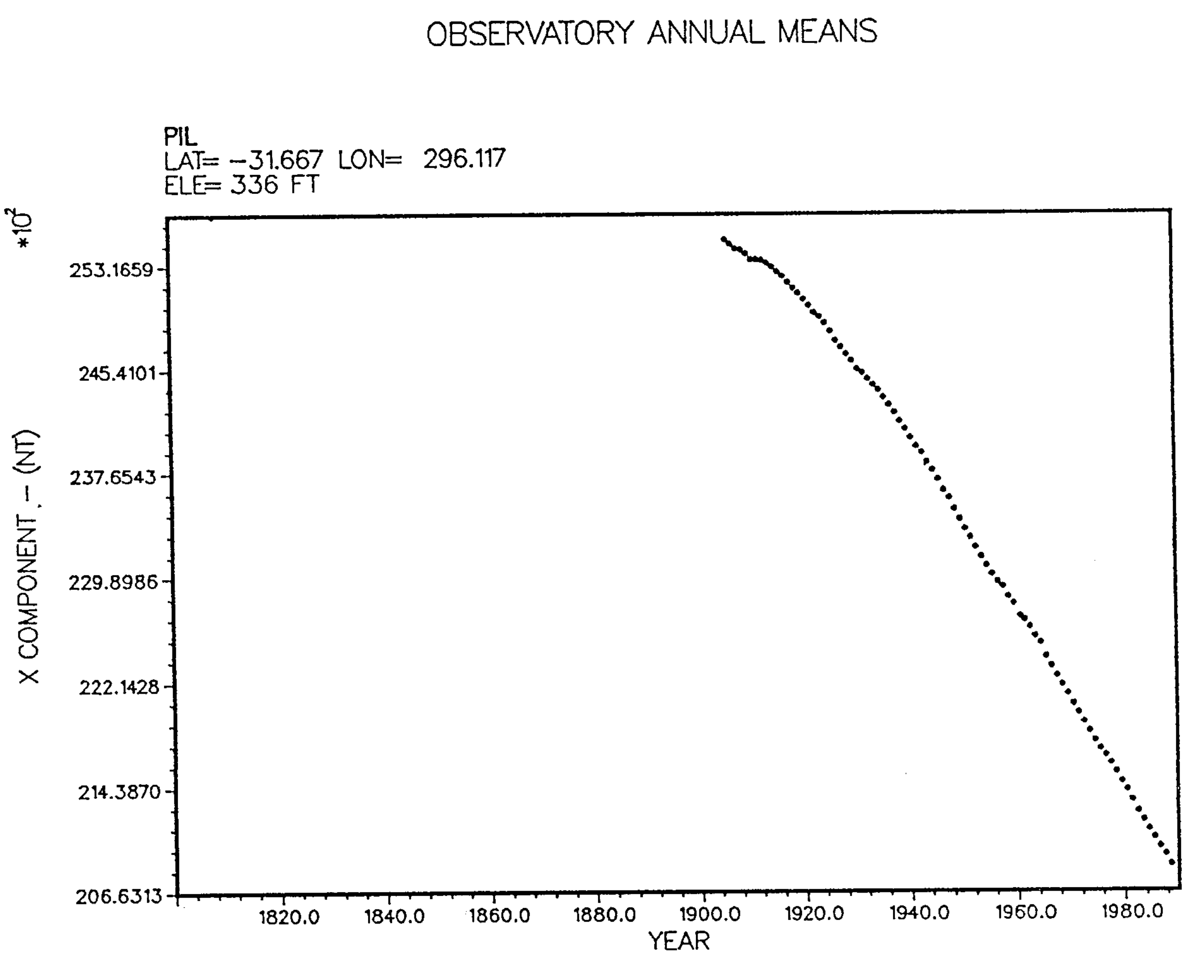


Figure 3a. North **X** Component at Pilar (PIL)

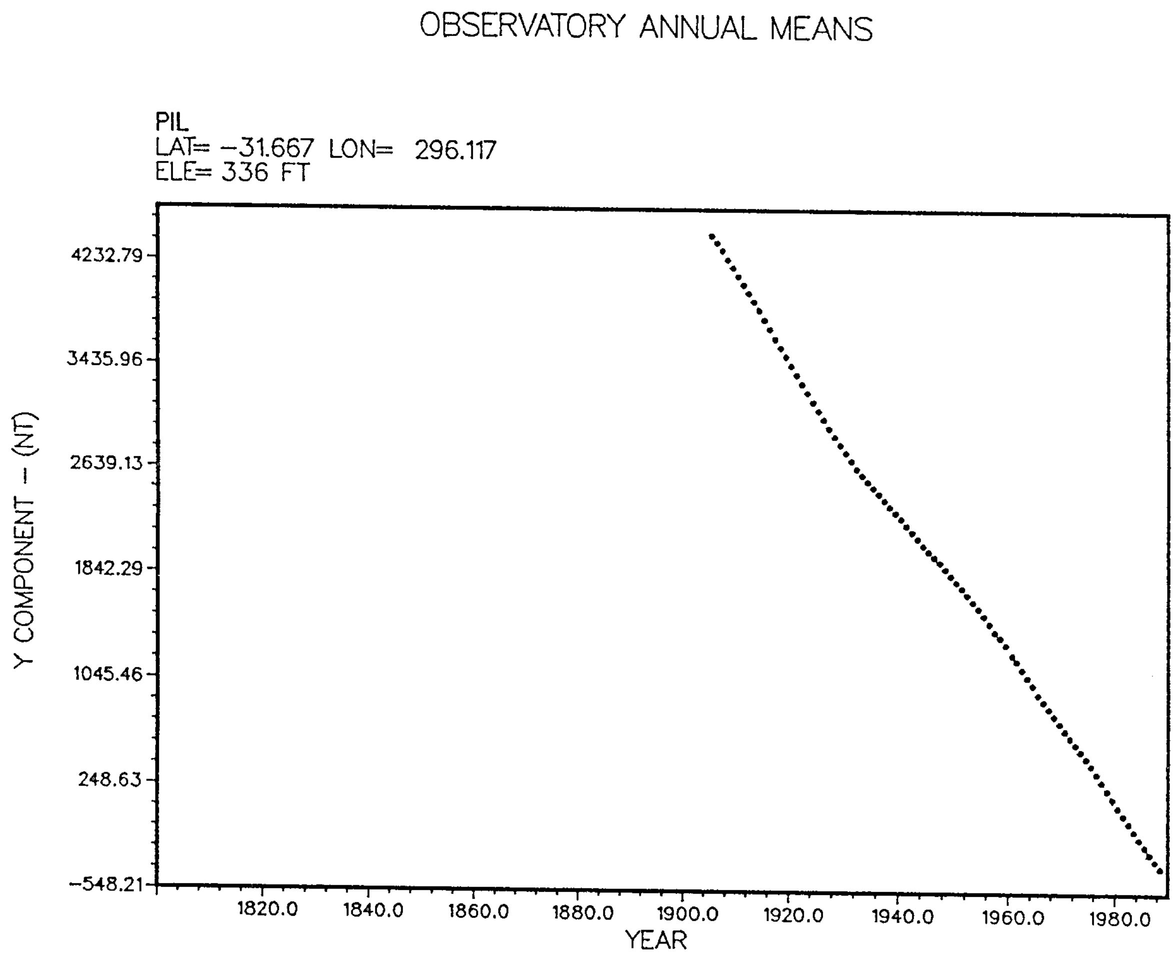


Figure 3b. East **Y** Component at Pilar (PIL)

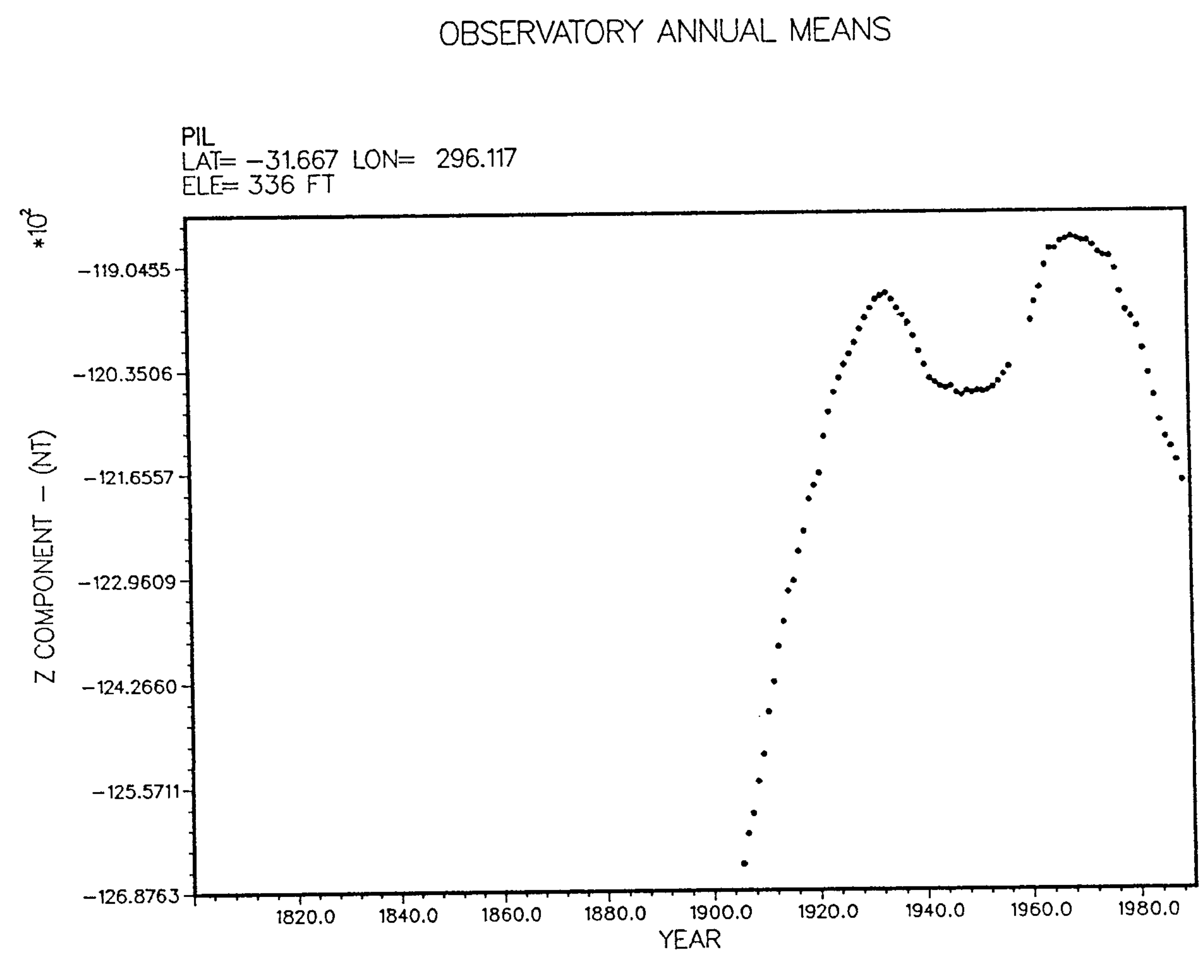


Figure 3c. Vertical **Z** Component at Pilar (PIL)

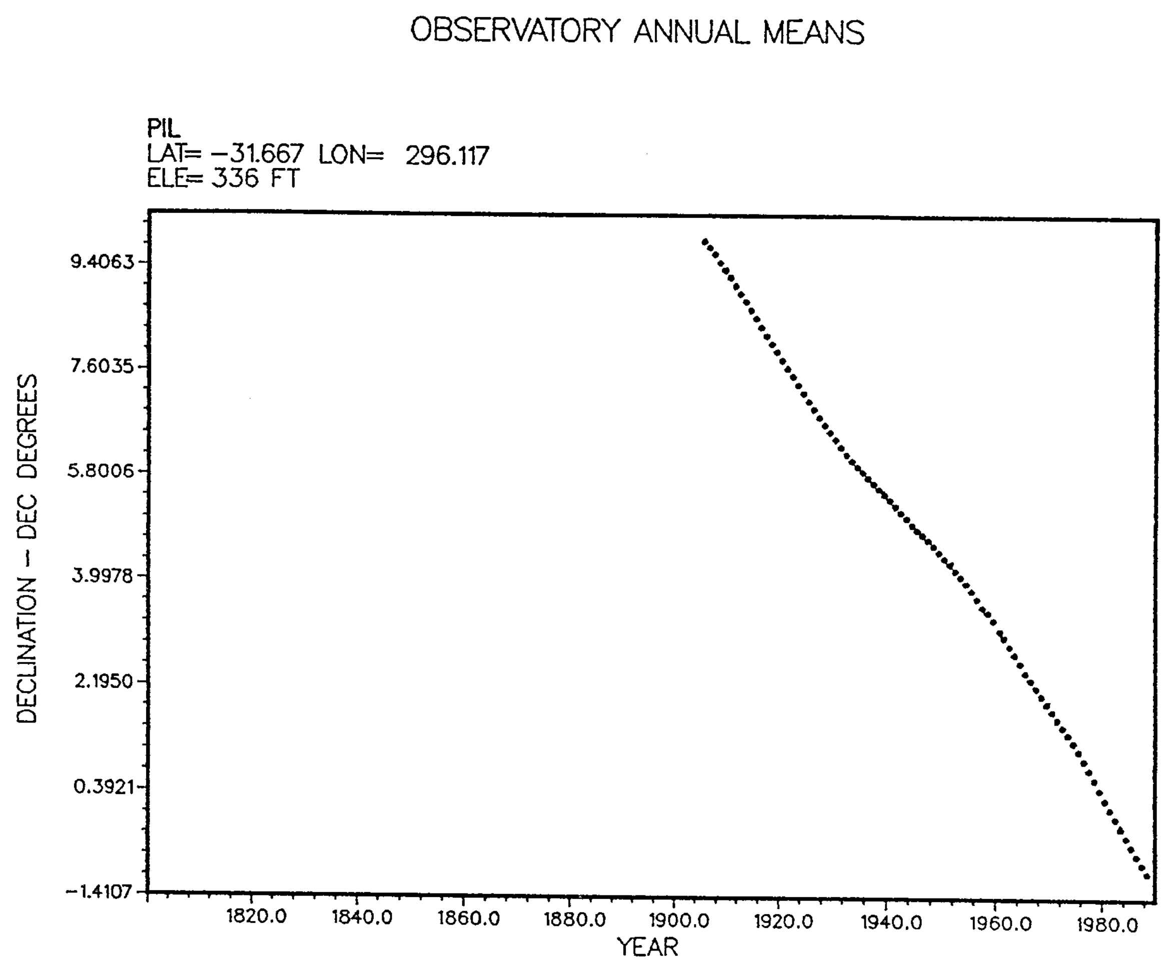


Figure 3d. Declination **D** Component at Pilar (PIL)

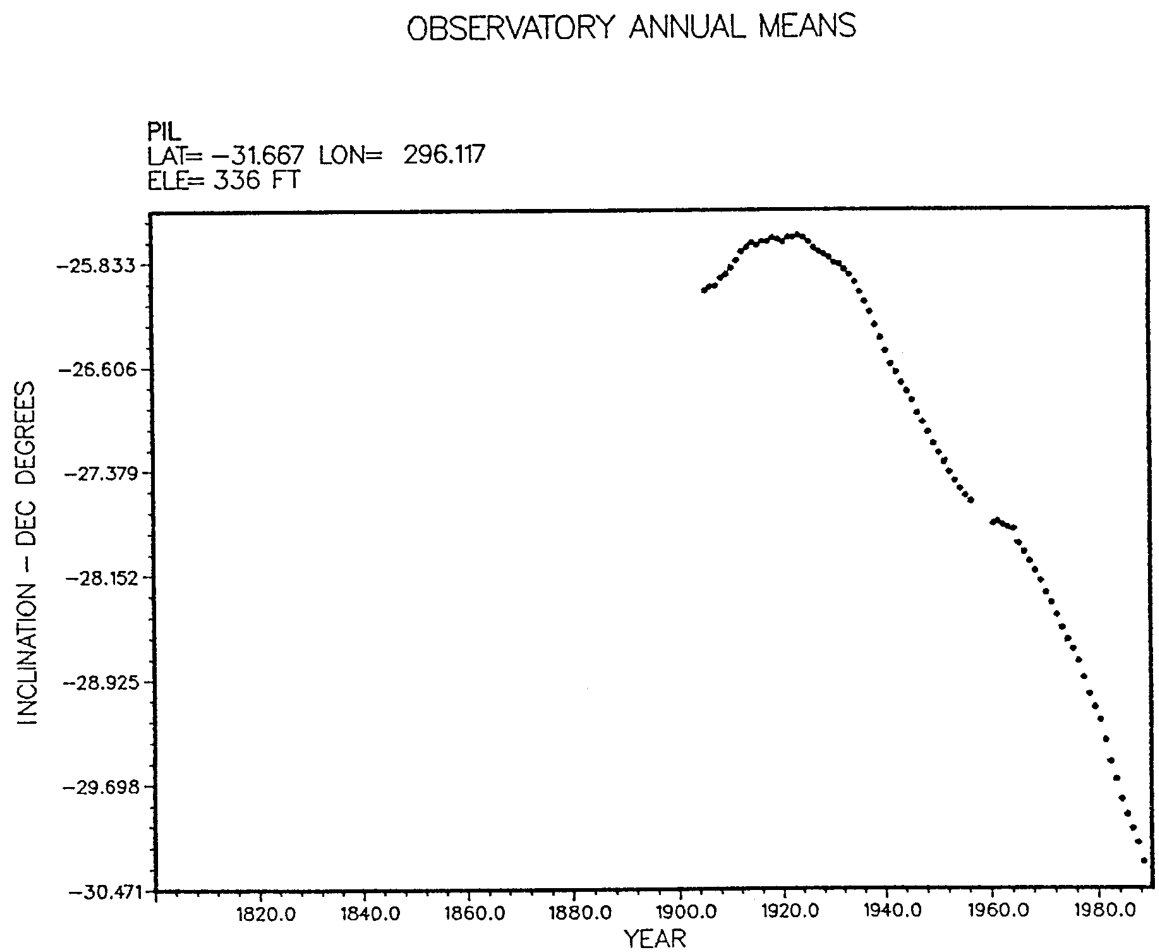


Figure 3e. Inclination **I** Component at Pilar (PIL)

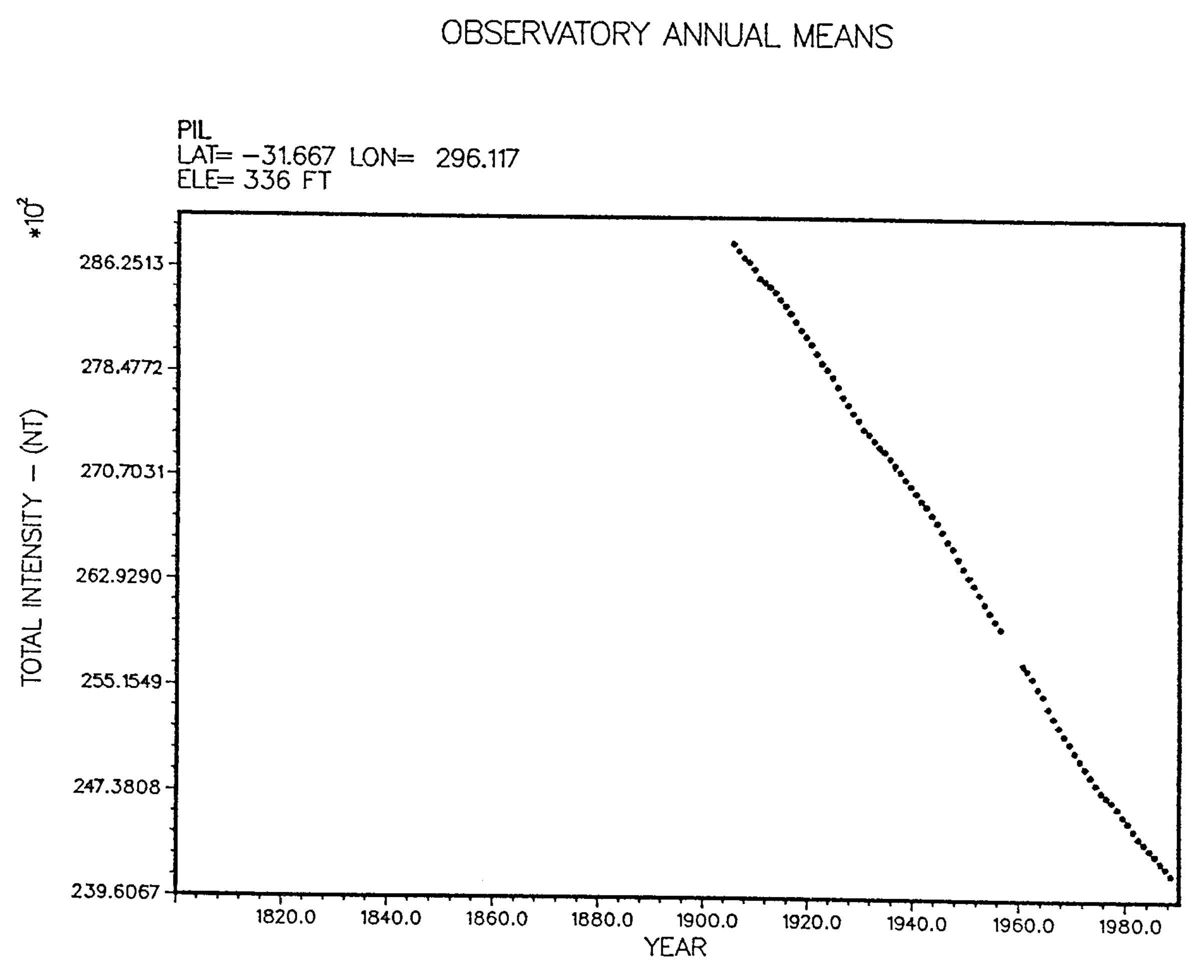


Figure 3f. Total Intensity **F** Component at Pilar (PIL)

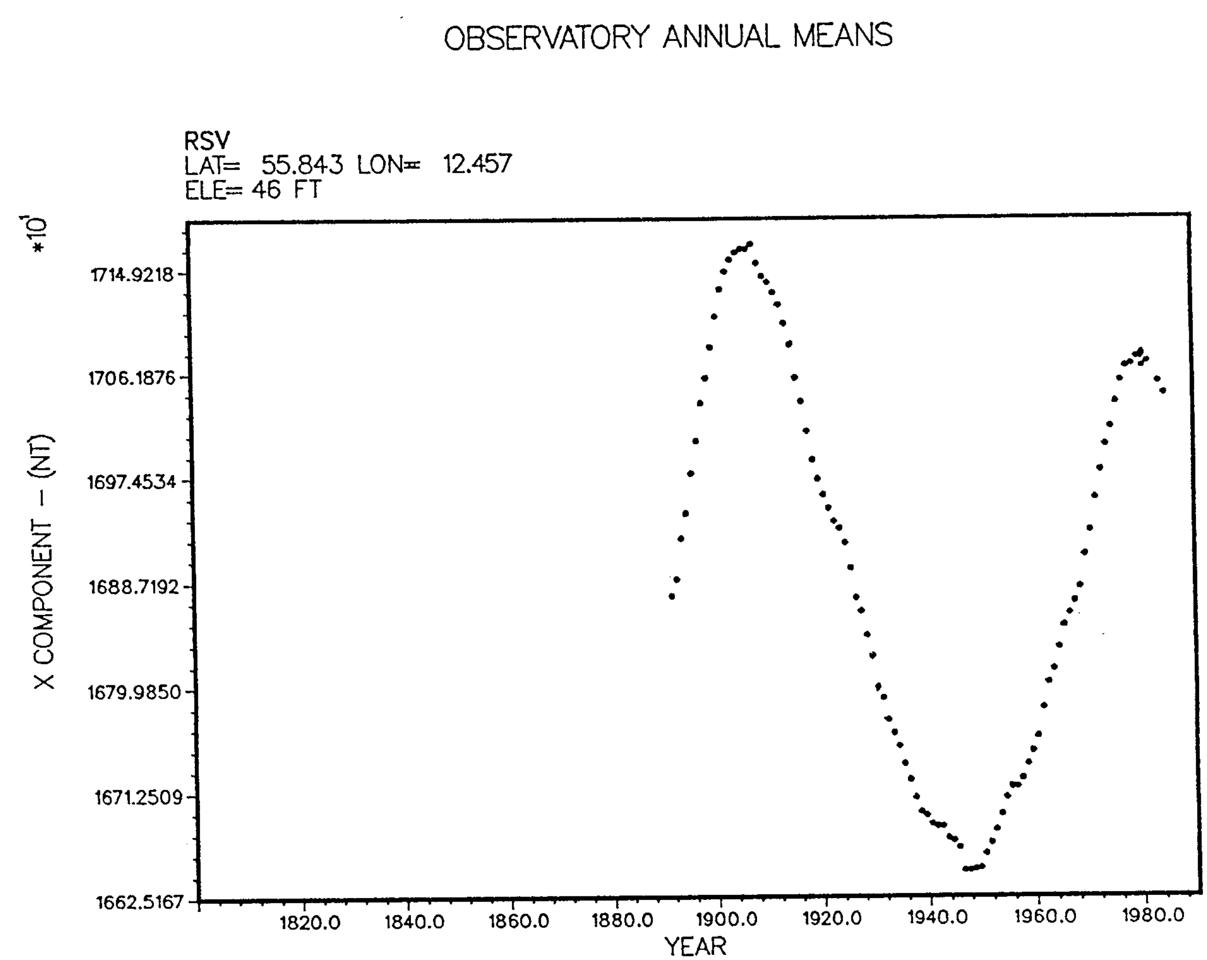


Figure 4a. North **X** Component at Rude Skov (RSV)

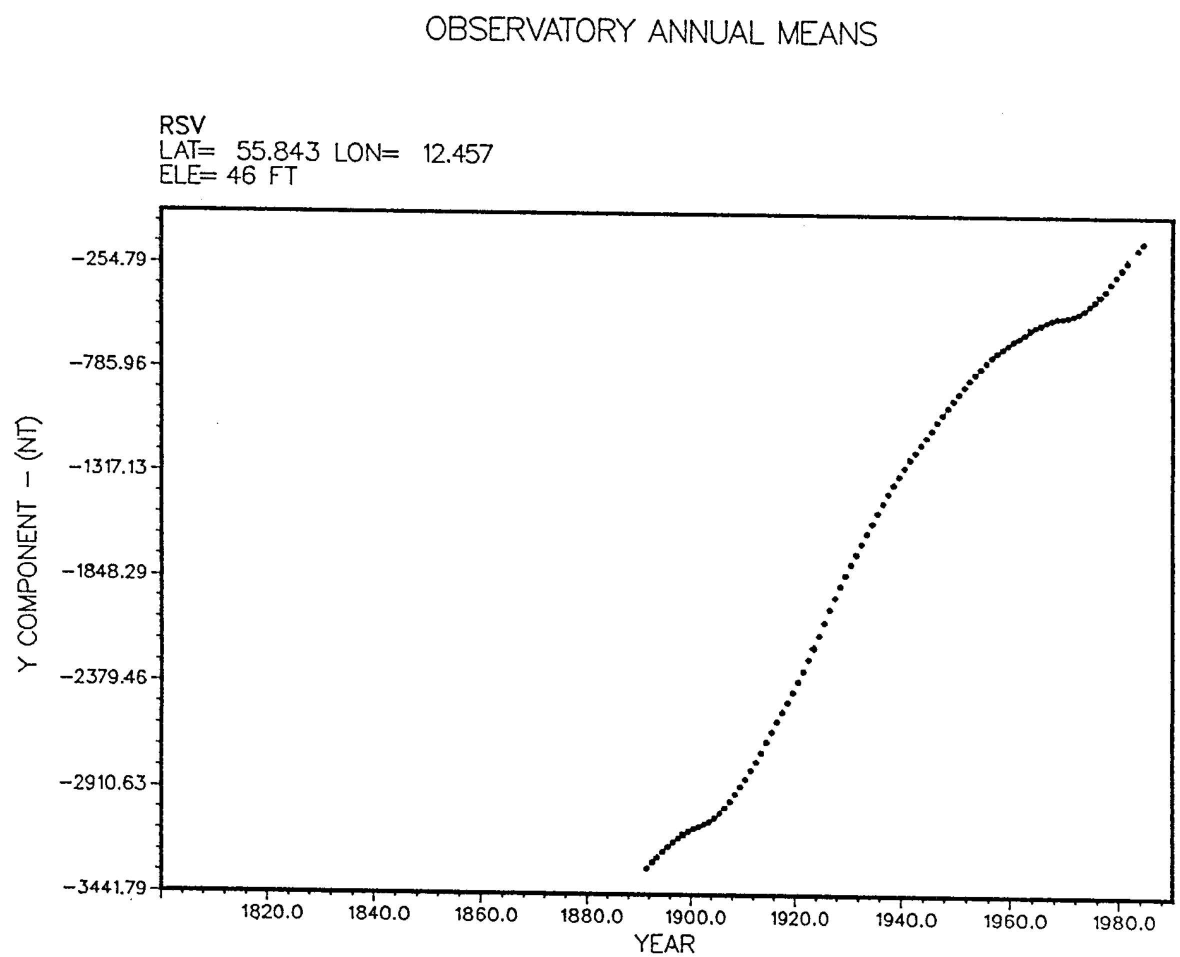


Figure 4b. East **Y** Component at Rude Skov (RSV)

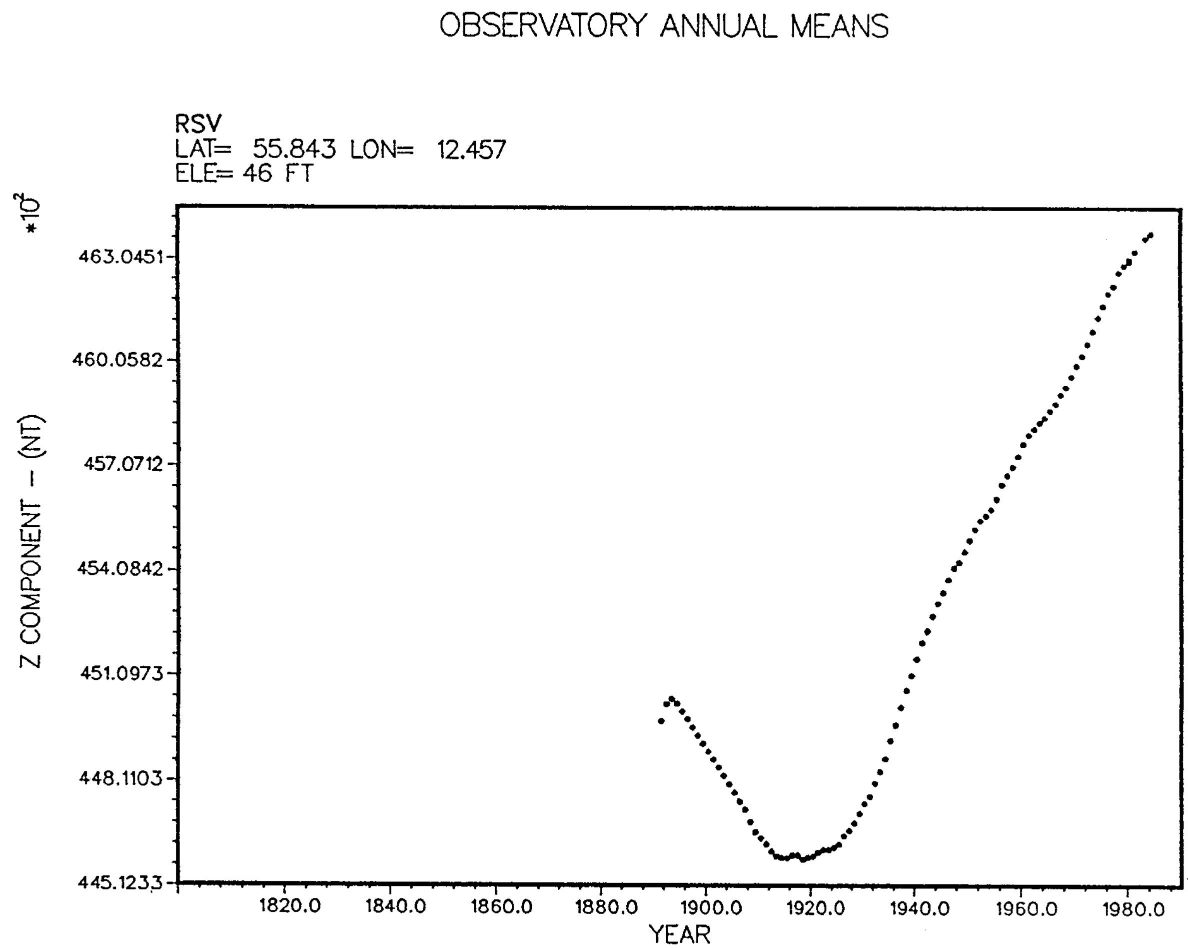


Figure 4c. Vertical **Z** Component at Rude Skov (RSV)

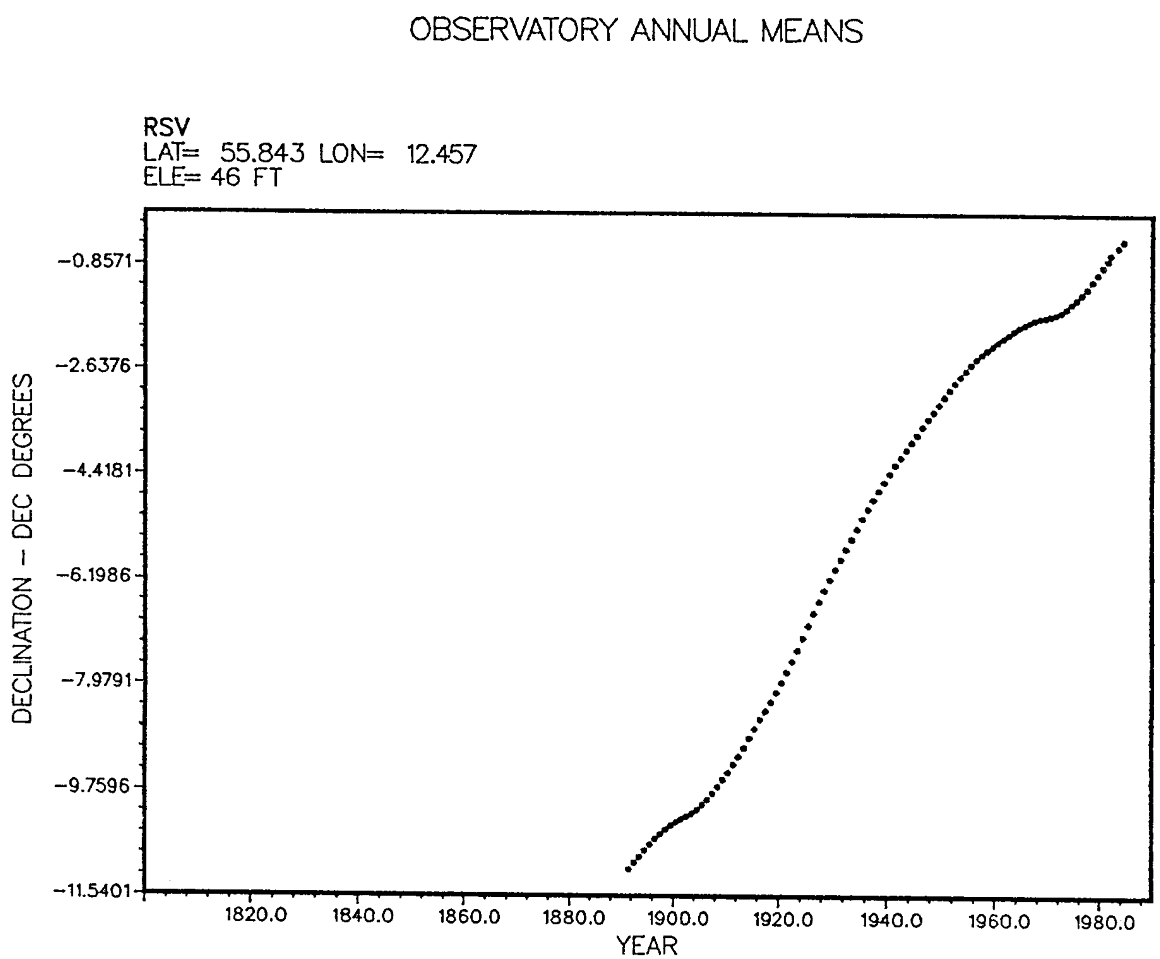


Figure 4d. Declination **D** Component at Rude Skov (RSV)

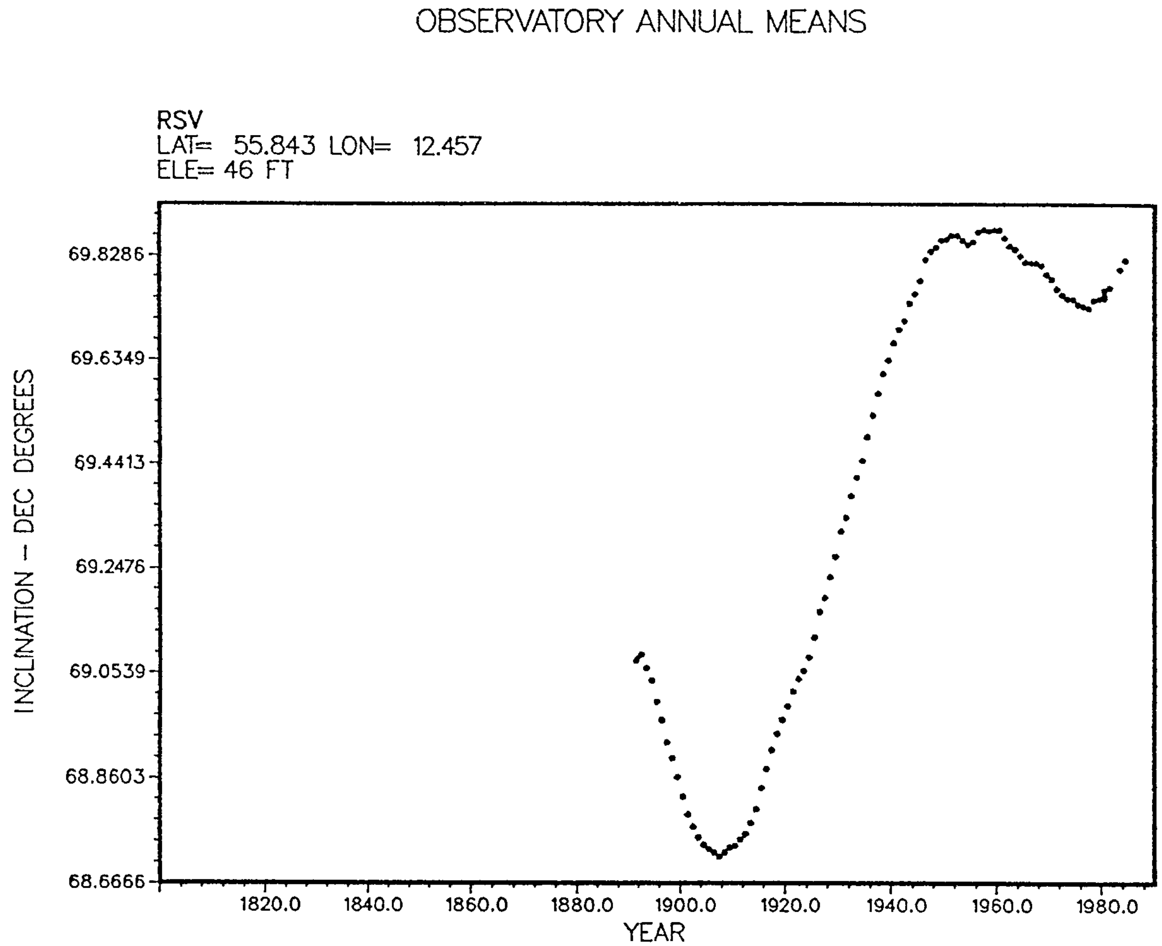


Figure 4e. Inclination **I** Component at Rude Skov (RSV)

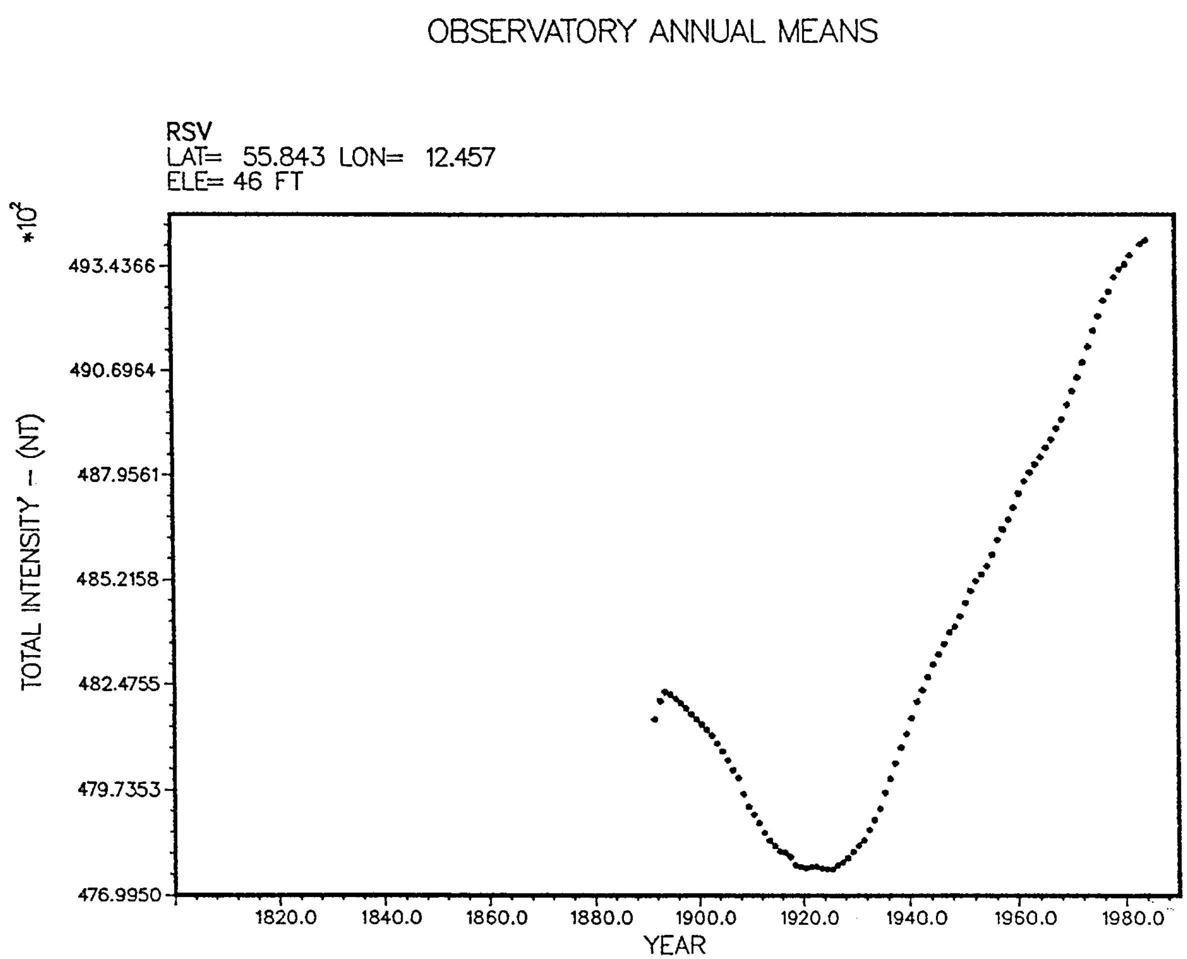


Figure 4f. Total Intensity **F** Component at Rude Skov (RSV)

changes and explains why it is necessary to make new spherical-harmonic geomagnetic-field models at 5-year intervals.

Quiet-Day annual-means data are used for SV modeling because magnetic fluctuations generated by external current sources, having periods of 1 year or less, tend to average out to zero over the course of 1 year. These fluctuating fields originate from a variety of current systems located *external* to the Earth's surface in the ionosphere (e.g., the Solar quiet (Sq) current system, Sabaka and Baldwin [1993]) and in the magnetosphere (e.g., the Ring current system). They also originate in current systems which couple the magnetosphere to the ionosphere (e.g., the Field-Aligned current systems). These external current systems are driven by the solar wind. Their associated fluctuating magnetic fields induce currents *internal* to the Earth's surface in the Earth's crust and mantle. These induced currents in turn generate corresponding induction fields which emanate from Earth's crust and mantle. This inductive process takes place as a consequence of the finite conductivities associated with both the crust and mantle. Magnetic fluctuations, from both external and induced internal origins having periods greater than 1 year, still contaminate the annual-means data. The most significant of these magnetic fluctuations are related to the 11-year and 22-year solar cycles. The long-term magnetic fluctuations in the annual-means data set are considered to be small and are generally ignored because many observatories do not have a sufficiently long history for a detailed analysis of their annual means data and because the external fields are not sufficiently well understood to generate accurate external-field correction models. The penalty for not removing the long-period external and induced fields is an increased uncertainty in the SV Gauss coefficients.

2.2 Main Field Data Analysis

2.2.1 Observatory Data

The Observatory magnetic annual-means data were not directly used in the MF modeling because those data contain, in addition to small external field contributions, some rather large local and regional magnetic biases of crustal origin. A detailed regional survey around each observatory site would be necessary to isolate and remove these biases. Alternatively, these biases could be computed as part of the MF modeling process. However, this approach is somewhat controversial since modeling at different epochs, not far apart in time, will yield substantially different observatory magnetic biases at one site. This bias variability is partly due to the local induction field that exists at each site. This field depends on the local conductivity distribution, which is generally unknown, and on the time-dependent external driving fields from the ionosphere and magnetosphere. The annual-means data were used indirectly in the MF modeling through the two definitive SV models referred to in the previous section. These SV models are derived from the first differences of the annual means data, which are independent of the observatory biases. They were used to adjust the Project MAGNET vector-aeromagnetic data forward and backward in time to match the mean epochs of 14 POGS data subsets which covered the time span from 1991.0 to 1993.7. Or, put another way, the entire Project MAGNET data set was copied 14 times with each copy adjusted to one of the 14 epochs of a particular POGS data subset. These adjustments were accomplished using the WMM-90 (modified) SV model.

2.2.2 Project MAGNET Data

The Project MAGNET vector-aeromagnetic data consists of two data subsets. The first data set consists of 78 high-altitude ($\geq$ 15,000 ft.) survey flights which were flown from October 1988 through September 1990. This data set corresponds to projects with the C32 designation and was collected prior to the structural remodeling of the Project MAGNET aircraft which took place during 1991 and 1992. The second data set consists of 56 high-altitude survey flights which were flown from January through December 1993. This data set corresponds to projects with the D32 designation. The processed data consists of one vector sample every 2 seconds (i.e., 0.5 Hz sample rate) yielding 1,216,686 vector records for the C32 project flights and 1,050,462 vector records for the D32 project flights. Approximately every one-hundredth vector record was selected for modeling purposes, yielding 10,658 vector records for the C32 flights and 9,360 vector records of the D32 flights for a total of 20,018 vector records. All 2,267,148 vector records were employed to determine the statistics for weighting the data selected from each flight.

The Project MAGNET data calibration and data reduction procedures are described by Coleman (1992). The statistics for each magnetic component of each flight for the C32 projects are given in table 5, while statistics for the D32 projects are given in table 6. The statistics for those data collected prior to 1990.0 were computed with respect to the WC-85 *(updated)* model listed in table 7. It is composed of the WC-85 *(revised)* model listed in NAVOCEANO Technical Report No. 304 (Quinn et al. [1991]) and the revised BGS definitive 1987.5 SV model listed in table 4 of this report. The statistics for those data collected post 1990.0 were computed using the WMM-90 (modified) model, the coefficients for which are listed in table 8. This model is composed of the WC-85 *(revised)* MF Gauss coefficients adjusted to the 1990.0 Epoch using the revised BGS definitive 1987.5 SV model and combining the resulting MF coefficients with the BGS definitive 1992.5 SV model listed in table 4. The RMS values thus computed for each flight were used as weight factors in the modeling process. These statistics indicate that the **Y**-component magnetic data has a strong bias probably associated with a **Y**-component attitude bias error in the ring-laser gyro. Nevertheless, the **Y**-component magnetic field data was used in the modeling but was given less weight in accordance with the statistics displayed in table 5 and table 6.

The Project MAGNET aircraft is a Lockheed RP3D Orion. Prior to 1990 its instrument suite consisted of a Honeywell fluxgate vector magnetometer; a Texas Instruments ASQ-81 absolute-scalar, metastable-helium magnetometer; a GPS receiver; a precision barometric altimeter; and an electrostatic gyro for attitude determination. Post 1990 the electrostatic gyro was replaced with a ring-laser gyro, and a radar altimeter was added to the instrument suite. For post-1990 modeling only the radar altimeter data were used for height determinations since the barometric data yielded slightly larger RMS magnetic field statistics with respect to a given field model than did the edited radar altimeter data. The accuracies of the instruments composing this Project MAGNET instrument suite are given by Coleman (1992). Procedures used for both calibrating the vector magnetometer and compensating the vector magnetometer data for the magnetic fields generated by the aircraft itself are also given by Coleman (1992). Data from these instruments was time synced to within 10 milliseconds. Surveys were flown at night (local time) to minimize solar-driven external field effects that contribute to the magnetic Daily

Table 5. Project MAGNET Magnetic Field Flight Statistics
wrt. WMM-90 (modified), Year > 1990
wrt. WC-85 (updated), Year < 1990

Project	Flight	Year	Day Begin	Day End	Records		Bx (nT)	By (nT)	Bh (nT)	Bz (nT)	Bfv (nT)	Bfs (nT)	Dec (Deg.)	Inc (Deg.)
C32-951	1171	1988	278	278	15199	Mean	-19.0	-4.5	-16.0	12.1	-0.5	14.9	-0.019	-0.026
						Std	58.6	49.5	58.8	53.9	55.9	41.1	0.115	0.086
						Rms	61.6	49.7	60.9	55.3	55.9	43.7	0.117	0.090
	3177	1988	308	308	17323	Mean	-39.7	-60.7	-50.3	-3.7	-56.7	-49.6	-0.094	-0.024
						Std	56.6	54.3	58.2	78.7	59.8	61.5	0.094	0.119
						Rms	69.1	81.5	77.0	78.8	82.4	79.0	0.133	0.121
	4119	1988	281	281	15090	Mean	20.8	-32.2	14.1	-31.9	18.8	3.5	-0.075	-0.029
						Std	67.3	30.9	63.3	54.7	68.6	80.6	0.075	0.099
						Rms	70.4	44.6	64.8	63.3	71.1	80.7	0.106	0.103
	4120	1988	297	297	15488	Mean	-14.4	37.6	-4.2	-65.2	34.1	38.0	0.094	-0.102
						Std	36.1	63.3	41.1	73.1	55.6	56.1	0.138	0.116
						Rms	38.9	73.7	41.3	98.0	65.3	67.8	0.167	0.154
	4121	1988	300	300	15809	Mean	-72.7	-145.0	-122.9	-42.6	-47.5	-50.7	-0.240	-0.193
						Std	50.4	72.5	61.1	124.5	101.8	101.0	0.151	0.116
						Rms	88.5	162.1	137.2	131.6	112.4	113.1	0.284	0.225
	4122	1988	284	284	16133	Mean	-62.1	-66.1	-85.0	-44.9	-18.1	-13.3	-0.075	-0.145
						Std	41.0	135.6	84.5	108.4	77.1	75.3	0.276	0.160
						Rms	74.4	150.8	119.9	117.3	79.2	76.5	0.286	0.216
	4123	1988	287	287	17469	Mean	-48.7	-54.7	-73.4	-45.1	7.7	3.7	-0.050	-0.110
						Std	87.0	77.0	95.6	109.5	103.5	101.6	0.172	0.121
						Rms	99.7	94.5	120.5	118.4	103.8	101.7	0.179	0.163
	4124	1988	291	291	14013	Mean	-25.0	-19.5	-28.5	-48.5	28.5	29.9	-0.017	-0.066
						Std	80.1	48.8	75.0	78.3	71.5	72.2	0.155	0.111
						Rms	83.9	52.5	80.2	92.1	77.0	78.1	0.157	0.129
	4125	1988	295	295	10643	Mean	-75.7	19.0	-62.8	-88.8	17.8	22.4	0.109	-0.177
						Std	41.8	63.4	48.6	95.3	51.4	55.2	0.144	0.153
						Rms	86.5	66.2	79.4	130.3	54.4	59.6	0.181	0.234
	4126	1988	303	303	18600	Mean	6.1	-38.5	-2.4	35.2	3.1	8.6	-0.077	0.060
						Std	38.5	64.9	35.5	72.3	44.5	45.7	0.132	0.117
						Rms	39.0	75.5	35.6	80.4	44.6	46.5	0.153	0.131
	4127	1988	311	311	17764	Mean	-44.1	-15.2	-45.0	43.9	-74.5	-64.4	-0.001	-0.023
						Std	65.8	63.3	67.5	101.9	75.2	73.8	0.130	0.111
						Rms	79.3	65.1	81.2	110.9	105.9	97.9	0.130	0.113
C32-951	4128	1988	314	314	17915	Mean	-4.1	42.8	20.4	38.2	-29.6	-31.7	0.118	0.031
						Std	65.1	68.2	55.4	85.1	81.0	82.1	0.238	0.060
						Rms	65.2	80.5	59.1	93.3	86.3	88.0	0.265	0.067

C32-951	4129	1988	318	318	17333	Mean	45.4	-4.4	-45.1	-5.2	-20.2	-24.1	0.013	-0.046
						Std	70.3	71.1	74.3	108.3	103.3	101.2	0.139	0.088
						Rms	83.7	71.2	86.9	108.4	105.3	104.1	0.139	0.099
	4130	1988	321	321	18635	Mean	-42.7	-90.7	-81.6	-27.9	12.5	19.0	-0.271	-0.074
						Std	107.5	91.6	115.2	107.5	116.1	114.4	0.468	0.096
						Rms	115.7	128.9	141.2	111.1	116.8	115.9	0.541	0.121
	4131	1988	328	328	17660	Mean	-56.4	-6.9	-55.6	12.3	-39.0	-40.3	0.016	-0.044
						Std	66.6	83.2	77.0	97.4	89.4	89.3	0.157	0.092
						Rms	87.3	83.5	95.0	98.2	97.6	97.9	0.157	0.102
	4132	1988	331	331	16082	Mean	-20.4	-51.7	-32.1	33.2	-45.5	-31.1	-0.084	-0.002
						Std	50.2	60.8	53.6	75.3	67.5	66.7	0.110	0.082
						Rms	54.1	79.8	62.5	82.3	81.4	73.6	0.139	0.082
	4133	1988	334	334	18630	Mean	-35.2	0.2	-34.7	-27.7	-28.0	-33.9	0.012	-0.062
						Std	48.8	52.2	49.8	68.9	51.2	50.4	0.090	0.112
						Rms	60.2	52.2	60.7	74.3	58.4	60.7	0.091	0.128
	4135	1988	345	345	18281	Mean	-20.0	-4.8	-20.6	68.2	18.1	2.2	-0.003	0.105
						Std	28.2	37.8	30.4	65.7	41.4	35.9	0.067	0.100
						Rms	34.5	38.1	36.7	94.7	45.2	36.0	0.068	0.144
C32-951	5084	1988	324	324	13951	Mean	5.5	-39.7	-7.8	33.1	-32.8	-29.1	-0.119	0.005
						Std	29.2	50.6	33.6	46.5	44.5	0.1	0.034	0.033
						Rms	29.7	64.3	34.5	57.0	56.3	53.1	0.188	0.040
C32-953	1181	1989	130	130	2354	Mean	-81.7	-42.9	-75.1	26.6	-1.6	-3.8	-0.153	0.083
						Std	93.1	76.3	96.3	121.2	102.4	104.5	0.217	0.119
						Rms	123.8	87.5	122.1	124.1	102.4	104.6	0.265	0.145
	1181	1989	131	131	8699	Mean	-53.5	-28.8	-52.2	21.6	0.7	-0.8	-0.085	0.059
						Std	101.3	88.9	102.1	129.8	118.3	118.1	0.243	0.121
						Rms	114.5	93.4	114.7	131.6	118.3	118.1	0.258	0.134
	1182	1989	181	181	4831	Mean	-83.8	22.0	-82.6	15.5	-35.1	-26.8	0.068	0.089
						Std	38.0	57.6	40.7	51.0	50.3	47.0	0.116	0.059
						Rms	92.0	61.6	92.1	53.4	61.3	54.1	0.135	0.107
	3180	1989	158	158	11758	Mean	-84.4	36.7	-85.9	-6.9	-77.3	-73.6	0.053	0.054
						Std	78.3	42.1	77.9	77.4	63.8	63.5	0.073	0.122
						Rms	115.2	55.8	116.0	77.7	100.3	97.2	0.090	0.133
	3180	1989	160	160	2223	Mean	-85.6	-10.7	-85.3	40.9	-59.4	-66.6	-0.019	0.098
						Std	39.7	28.7	39.9	38.0	40.2	42.4	0.042	0.052
						Rms	92.7	34.3	92.3	73.2	62.9	69.9	0.052	0.133
C32-953	3181	1989	162	162	13901	Mean	-107.2	23.3	-107.6	105.7	-66.7	-67.5	0.033	0.200
						Std	49.7	34.8	49.9	77.7	40.0	40.2	0.054	0.118
						Rms	118.1	41.8	118.6	131.1	77.8	78.6	0.063	0.232

C32-953	3182	1989	166	166	16545	Mean	-57.8	1.4	-57.5	35.2	-26.2	-26.5	0.012	0.079
						Std	62.4	50.2	62.7	106.9	60.8	61.8	0.090	0.181
						Rms	85.1	50.2	85.1	112.5	66.2	67.3	0.090	0.197
	3183	1989	169	169	16229	Mean	-17.7	-29.4	-21.6	19.9	-23.6	-14.1	-0.044	0.019
						Std	50.3	50.1	51.0	74.1	52.3	53.2	0.082	0.117
						Rms	53.3	58.1	55.4	76.7	57.4	55.1	0.093	0.119
	4137	1989	175	175	17470	Mean	-11.0	-37.6	-17.1	-9.3	-18.3	-28.9	-0.062	-0.019
						Std	53.8	47.6	55.0	80.7	56.2	55.0	0.082	0.134
						Rms	54.9	60.7	57.6	81.3	59.1	62.2	0.103	0.135
C32-953	4138	1989	179	179	18325	Mean	8.5	10.6	10.2	88.0	17.8	-0.9	0.017	0.144
						Std	39.0	48.8	38.9	68.3	48.6	42.8	0.089	0.125
						Rms	39.9	50.0	40.2	111.4	51.8	42.8	0.090	0.190
C32-954	1184	1989	207	207	15871	Mean	-27.8	95.0	-81.8	-51.4	-68.9	-64.5	0.362	0.067
						Std	95.3	115.8	116.6	95.2	84.7	85.6	0.539	0.132
						Rms	99.3	149.7	142.4	108.2	109.2	107.2	0.649	0.148
	1186	1989	212	212	12679	Mean	-42.6	-42.0	-29.1	-12.7	-18.2	-20.6	-0.211	0.025
						Std	101.8	168.3	117.3	81.4	74.3	73.3	0.753	0.136
						Rms	110.3	173.5	120.8	82.3	76.5	76.1	0.782	0.139
	1188	1989	218	218	18140	Mean	1.6	-29.4	14.0	-24.1	-20.7	-22.1	-0.035	-0.022
						Std	133.2	112.2	134.3	83.2	77.2	78.1	0.459	0.155
						Rms	133.2	116.0	135.0	86.7	80.0	81.2	0.460	0.157
	1189	1989	223	223	16469	Mean	-15.7	-22.3	-6.6	-15.5	-13.3	-18.2	-0.224	-0.003
						Std	113.8	134.0	110.7	107.6	98.4	97.5	0.593	0.133
						Rms	114.9	135.9	110.9	108.7	99.3	99.2	0.633	0.133
	1190	1989	228	228	16737	Mean	-124.0	18.1	-124.4	63.1	13.1	3.6	-0.116	0.165
						Std	192.0	159.7	195.5	125.3	106.9	106.4	0.632	0.234
						Rms	228.6	160.7	231.7	140.3	107.6	106.5	0.643	0.286
	1195	1989	267	267	17301	Mean	-32.0	68.8	-51.2	-11.4	-48.7	-43.1	0.116	-0.055
						Std	45.3	29.7	48.8	65.9	42.8	47.7	0.054	0.134
						Rms	55.5	75.0	70.7	66.9	64.8	64.3	0.128	0.145
	1196	1989	270	270	13055	Mean	-100.5	-75.5	-79.4	87.0	28.6	16.0	-0.207	0.142
						Std	34.8	70.4	35.5	63.0	60.7	61.2	0.170	0.049
						Rms	106.4	103.3	87.0	107.4	67.1	63.2	0.268	0.150
	1198	1989	234	234	17895	Mean	-222.8	-70.8	-189.0	43.4	-30.1	-33.6	-0.404	0.215
						Std	67.1	66.6	65.2	85.5	78.9	78.0	0.239	0.081
						Rms	232.7	97.2	200.0	95.8	84.4	84.9	0.469	0.230
C32-954	1199	1989	244	244	2842	Mean	-100.2	-66.7	-81.2	59.2	18.9	19.8	-0.229	0.109
						Std	31.7	63.2	38.0	67.5	60.6	59.6	0.162	0.054
						Rms	105.1	91.8	89.7	89.8	63.4	62.8	0.281	0.122

C32-954	1199	1989	246	246	17885	Mean	6.3	76.3	-16.1	-89.0	-28.2	-23.8	0.150	-0.200
						Std	73.8	77.0	86.0	58.1	49.0	38.7	0.129	0.120
						Rms	74.1	108.4	87.5	106.2	56.6	45.4	0.198	0.234
	2052	1989	247	247	15485	Mean	-92.4	67.8	-111.0	3.7	-83.8	-85.7	0.094	-0.272
						Std	65.2	51.8	61.3	87.1	91.8	92.0	0.189	0.120
						Rms	113.1	85.3	126.8	87.2	124.3	125.7	0.211	0.210
	2055	1989	258	258	10055	Mean	1.3	-5.8	1.6	-54.8	44.2	31.6	-0.015	-0.063
						Std	52.5	47.9	51.8	61.4	57.8	57.8	0.142	0.094
						Rms	52.5	48.3	51.9	82.3	72.8	65.9	0.142	0.113
	2056	1989	261	261	5620	Mean	-30.2	72.1	-51.9	-54.6	-3.1	-4.1	0.194	-0.184
						Std	40.7	64.3	39.0	80.9	58.6	59.9	0.216	0.159
						Rms	50.8	96.7	64.9	97.6	58.7	60.0	0.291	0.243
	2057	1989	263	263	12017	Mean	-68.1	11.1	-68.4	42.7	-70.9	-80.7	-0.014	-0.003
						Std	51.8	33.3	51.9	69.0	52.4	51.6	0.078	0.147
						Rms	85.6	35.1	85.9	81.1	88.2	95.8	0.079	0.147
	4139	1989	255	255	16393	Mean	-67.5	-86.0	-109.3	-56.8	-3.9	-1.5	-0.091	-0.159
						Std	68.7	106.2	76.5	91.6	85.2	89.4	0.252	0.097
						Rms	96.3	136.6	133.4	107.8	85.3	89.4	0.268	0.186
C32-954	7012	1989	252	252	4819	Mean	-111.3	6.5	-111.0	-77.5	-0.5	11.6	0.054	-0.218
						Std	36.8	34.7	35.1	43.8	36.5	38.2	0.092	0.067
						Rms	117.2	35.3	116.4	89.0	36.5	39.9	0.107	0.228
C32-051	3184	1989	348	348	2725	Mean	-45.8	-17.6	-46.8	134.7	17.9	-0.1	-0.019	0.234
						Std	67.8	50.4	68.4	81.8	72.5	69.9	0.093	0.134
						Rms	81.8	53.4	82.6	157.5	74.7	69.9	0.095	0.269
	3185	1989	352	352	13084	Mean	-226.4	70.3	-204.6	159.2	0.4	-4.2	0.257	0.339
						Std	45.5	72.8	51.5	81.3	69.3	58.7	0.151	0.085
						Rms	231.0	101.2	211.0	178.8	69.3	59.0	0.298	0.350
	4140	1989	302	302	11505	Mean	-55.1	45.1	-46.9	-95.0	-12.1	-21.5	0.109	-0.172
						Std	24.3	33.5	25.4	79.0	59.1	51.5	0.070	0.146
						Rms	60.3	56.2	53.4	123.6	60.3	55.8	0.129	0.226
	4141	1989	303	303	13179	Mean	-57.2	16.3	-52.1	29.7	-58.7	-69.0	0.054	-0.009
						Std	56.4	67.1	56.3	94.2	86.5	84.2	0.130	0.112
						Rms	80.3	69.0	76.7	98.8	104.5	108.8	0.141	0.112
	4142	1989	304	304	9056	Mean	-77.5	29.5	-70.4	-94.4	-35.3	-50.7	0.079	-0.188
						Std	40.3	53.6	39.9	63.1	41.0	40.4	0.097	0.103
						Rms	87.3	61.2	80.9	113.5	54.1	64.8	0.125	0.215
C32-051	4143	1989	310	310	9332	Mean	-54.5	-16.5	-56.8	7.2	-44.5	-41.0	-0.004	-0.044
						Std	60.7	66.3	61.0	90.9	72.2	72.2	0.124	0.110
						Rms	81.6	68.3	83.3	91.2	84.9	83.0	0.124	0.119

C32-051	4144	1989	315	315	16235	Mean	34.3	-45.5	17.4	18.6	-7.7	-18.9	-0.229	0.023
						Std	72.0	89.8	85.1	103.2	100.1	100.8	0.290	0.091
						Rms	79.7	100.7	86.9	104.9	100.4	102.5	0.369	0.093
	5079	1989	318	318	15797	Mean	-42.7	-28.0	-45.3	25.8	-35.8	-50.8	-0.156	-0.037
						Std	64.4	48.2	65.3	49.6	46.8	48.3	0.278	0.058
						Rms	77.3	55.7	79.5	55.9	58.9	70.1	0.319	0.069
	5086	1989	341	341	11840	Mean	-55.8	41.3	-55.7	192.7	-57.6	-63.1	0.059	0.266
						Std	37.8	46.2	37.8	48.3	44.2	31.3	0.066	0.076
						Rms	67.4	62.0	67.3	198.7	72.6	70.4	0.088	0.277
	5089	1989	325	325	16513	Mean	-46.2	-18.4	-33.1	8.3	-18.6	-20.8	-0.127	-0.030
						Std	65.9	55.9	51.0	78.9	78.7	76.7	0.203	0.051
						Rms	80.5	58.8	60.8	79.3	80.9	79.5	0.240	0.059
	5090	1989	330	330	16208	Mean	-122.5	-5.0	-112.3	-32.5	-19.2	-11.5	-0.124	-0.133
						Std	88.8	75.7	86.5	107.3	102.3	101.7	0.215	0.097
						Rms	151.3	75.9	141.7	112.1	104.1	102.4	0.248	0.164
C32-051	5091	1989	332	332	14491	Mean	8.0	-54.7	12.4	44.1	-0.9	10.1	-0.104	0.078
						Std	53.2	57.3	53.4	99.3	66.9	78.1	0.130	0.148
						Rms	53.8	79.2	54.8	108.7	66.9	78.7	0.166	0.167
C32-052	1201	1990	18	18	15890	Mean	-30.0	114.7	-30.0	-22.0	-13.6	-10.1	0.240	-0.008
						Std	135.5	72.5	137.7	88.7	63.3	61.5	0.166	0.196
						Rms	138.8	135.7	141.0	91.4	64.7	62.4	0.292	0.196
	1202	1990	92	92	5032	Mean	40.9	-10.4	38.2	37.5	52.1	43.0	-0.029	-0.014
						Std	38.0	47.2	38.9	58.9	49.8	50.0	0.103	0.061
						Rms	55.8	48.3	54.5	69.8	72.1	70.0	0.107	0.062
	4145	1990	20	20	6295	Mean	4.3	34.0	14.6	-88.3	66.8	54.5	0.072	-0.105
						Std	80.7	92.1	77.2	100.2	80.3	80.3	0.206	0.167
						Rms	80.8	98.0	78.6	133.6	104.5	97.1	0.219	0.196
	4149	1990	90	90	14450	Mean	-58.9	45.5	-50.5	75.6	-25.0	-27.6	0.102	0.109
						Std	38.0	44.1	41.5	61.2	66.8	56.4	0.073	0.106
						Rms	70.1	63.4	65.4	97.3	71.3	62.8	0.126	0.152
	5094	1990	37	37	16913	Mean	-57.5	178.5	-43.8	-20.9	-4.0	-0.8	0.379	-0.051
						Std	76.7	78.9	74.6	105.7	102.9	103.6	0.166	0.081
						Rms	95.9	195.2	86.5	107.7	103.0	103.6	0.414	0.096
	5095	1990	40	40	5775	Mean	-62.3	194.2	-34.1	3.9	-23.3	-26.3	0.378	-0.029
						Std	95.1	95.5	97.6	122.1	108.5	108.4	0.177	0.122
						Rms	113.7	216.4	103.4	122.1	111.0	111.5	0.418	0.126
	5095	1990	43	43	12762	Mean	43.0	218.5	59.2	32.9	13.4	12.2	0.384	0.076
						Std	64.5	83.1	62.9	104.0	89.9	89.5	0.150	0.092
						Rms	77.5	233.8	86.4	109.1	90.9	90.3	0.413	0.120
C32-052	5096	1990	45	45	15918	Mean	-24.5	201.7	-10.5	0.0	-2.5	-2.7	0.361	-0.004
						Std	63.2	55.3	64.2	58.6	55.4	58.9	0.105	0.074
						Rms	67.8	209.1	65.0	58.6	55.5	58.9	0.376	0.074

C32-052	5097	1990	49	49	1188	Mean	-69.6	347.6	-84.1	46.0	-78.5	-76.3	0.791	-0.056
						Std	44.9	34.8	45.2	51.3	46.7	46.5	0.077	0.050
						Rms	82.8	349.3	95.4	68.9	91.3	89.4	0.795	0.075
	5098	1990	52	52	18456	Mean	40.8	115.9	-35.3	-43.4	21.1	25.3	0.400	-0.086
						Std	60.4	90.6	67.3	93.9	87.2	87.0	0.295	0.129
						Rms	72.9	147.1	76.0	103.5	89.7	90.6	0.500	0.155
	5099	1990	61	61	16865	Mean	-40.2	-3.2	-40.0	-36.4	-22.6	-10.4	-0.010	-0.056
						Std	57.0	49.0	56.5	87.5	51.4	54.2	0.077	0.142
						Rms	69.8	49.1	69.2	94.8	56.1	55.2	0.077	0.152
	5101	1990	67	67	4694	Mean	55.1	142.0	49.5	76.7	-43.2	-40.4	0.327	0.084
						Std	64.4	77.2	64.3	96.7	73.2	73.9	0.183	0.091
						Rms	84.8	161.6	81.1	123.4	85.0	84.2	0.375	0.124
	5102	1990	55	55	18103	Mean	42.9	42.4	25.9	-35.3	41.9	43.8	0.224	0.020
						Std	74.8	81.4	80.1	107.0	102.3	103.1	0.310	0.174
						Rms	86.2	91.8	84.2	112.7	110.5	112.0	0.382	0.175
	5103	1990	58	58	17936	Mean	-34.6	185.5	-69.0	-56.9	-2.0	-3.3	0.348	-0.126
						Std	49.6	78.9	48.1	66.7	58.0	57.3	0.152	0.084
						Rms	60.5	201.6	84.1	87.7	58.1	57.4	0.380	0.151
	5104	1990	70	70	13092	Mean	22.3	151.5	31.5	-4.1	25.9	25.7	0.293	0.025
						Std	105.2	114.7	106.0	134.5	126.3	126.1	0.245	0.123
						Rms	107.5	190.0	110.6	134.6	129.0	128.7	0.382	0.126
C32-052	5105	1990	75	75	13914	Mean	-79.5	222.1	-45.8	-33.9	6.6	2.4	0.475	-0.061
						Std	90.9	140.1	94.9	117.8	102.2	101.4	0.252	0.117
						Rms	120.7	262.6	105.3	122.5	102.4	101.4	0.538	0.132
C32-053	1205	1990	152	152	19896	Mean	-75.1	142.0	-52.7	55.7	23.4	17.4	0.344	0.092
						Std	87.6	78.8	94.3	107.9	96.5	95.3	0.201	0.109
						Rms	115.4	162.4	108.0	121.4	99.3	96.9	0.399	0.142
	4154	1990	155	155	16198	Mean	-33.3	146.8	-15.3	48.1	-28.2	-31.8	0.315	0.104
						Std	38.4	38.9	39.2	65.8	42.0	40.2	0.094	0.121
						Rms	50.9	151.9	42.1	81.5	50.6	51.2	0.328	0.159
	4158	1990	160	160	14500	Mean	-63.0	139.9	-50.8	48.4	-54.6	-50.4	0.310	0.076
						Std	41.4	44.8	41.6	54.3	54.1	42.9	0.078	0.099
						Rms	75.4	146.9	65.6	72.7	76.9	66.2	0.320	0.125
C32-053	4159	1990	160	160	6536	Mean	-11.3	170.5	-11.3	0.6	-5.1	-6.7	0.361	0.008
						Std	64.9	52.4	66.6	74.8	66.9	65.1	0.120	0.094
						Rms	65.9	178.4	67.5	74.8	67.1	65.4	0.381	0.095
C32-054	3194	1990	265	265	14901	Mean	71.0	-95.0	51.2	-13.8	5.9	6.7	-0.323	-0.060
						Std	79.6	74.0	78.2	97.8	99.6	99.2	0.222	0.084
						Rms	106.6	120.4	93.5	98.8	99.8	99.4	0.392	0.103

Table 6. Project MAGNET Magnetic Field Flight Statistics
wrt. WMM-90 (modified)

Project	Flight	Year	Day Begin	Day End	Records		Bx (nT)	By (nT)	Bh (nT)	Bz (nT)	Bfv (nT)	Bfs (nT)	Dec (Deg.)	Inc (Deg.)
D32-352	1214	1993	17	17	19981	Mean	-7.8	-37.0	-9.6	-9.1	-11.4	-21.6	-0.076	-0.013
						Std	48.5	45.1	51.2	65.1	58.4	54.5	0.097	0.088
						Rms	49.1	58.3	52.1	65.8	59.5	58.6	0.123	0.089
	1215	1993	73	73	21862	Mean	16.9	-158.8	-9.2	57.6	16.8	25.5	-0.303	0.093
						Std	38.2	46.3	40.9	48.4	39.2	39.0	0.080	0.078
						Rms	41.7	165.4	41.9	75.2	42.7	46.5	0.313	0.122
	2058	1993	21	22	21153	Mean	10.4	-178.3	-11.7	-52.4	-23.6	-26.5	-0.344	-0.086
						Std	42.4	32.5	39.2	64.0	47.1	45.6	0.058	0.113
						Rms	43.6	181.2	40.9	82.7	52.7	52.8	0.349	0.141
	2059	1993	28	28	18543	Mean	20.3	-154.0	-3.4	-39.9	0.7	-5.1	-0.328	-0.063
						Std	53.6	47.6	45.8	51.5	53.7	64.0	0.096	0.097
						Rms	57.3	161.2	45.9	65.2	53.7	64.2	0.342	0.116
	2060	1993	32	32	20122	Mean	6.3	-161.1	-25.6	19.7	-25.2	-22.4	-0.305	0.006
						Std	72.1	47.4	72.2	71.2	78.4	68.9	0.099	0.121
						Rms	72.3	167.9	76.5	73.9	82.4	72.5	0.320	0.120
	3204	1993	49	50	18087	Mean	25.8	-212.7	9.0	10.6	16.7	20.1	-0.365	0.016
						Std	68.6	45.7	64.3	77.7	62.0	60.9	0.070	0.127
						Rms	73.3	217.6	64.9	78.4	64.3	64.1	0.372	0.128
	3205	1993	52	52	16809	Mean	-93.7	-242.9	-91.8	90.3	-74.1	-74.8	-0.372	0.159
						Std	43.5	37.7	43.7	62.3	44.5	45.0	0.056	0.086
						Rms	103.3	245.8	101.7	109.7	86.4	87.2	0.376	0.181
	3206	1993	56	56	20377	Mean	57.2	-198.3	32.0	-11.1	32.1	29.7	-0.365	-0.042
						Std	70.0	52.4	66.8	86.6	69.7	70.4	0.095	0.136
						Rms	90.4	205.1	74.1	87.3	76.8	76.4	0.377	0.143
	3207	1993	58	58	21179	Mean	49.6	-210.7	14.3	-36.8	-0.9	0.1	-0.411	-0.072
						Std	60.7	44.1	61.3	84.0	68.4	69.6	0.081	0.132
						Rms	78.4	215.2	62.9	91.8	68.4	69.6	0.419	0.151
	3208	1993	63	63	21812	Mean	10.2	-138.2	-13.3	-53.5	-40.2	-33.4	-0.270	-0.060
						Std	70.6	47.4	72.2	80.4	72.1	69.3	0.096	0.132
						Rms	71.3	146.1	73.4	96.6	82.5	77.0	0.287	0.145
	3209	1993	66	66	21112	Mean	-15.9	-146.1	-40.2	-27.4	-48.5	-42.9	-0.264	-0.036
						Std	58.0	58.0	62.9	73.3	66.8	62.5	0.106	0.113
						Rms	60.1	157.2	74.6	78.2	82.6	75.6	0.284	0.119
D32-352	4160	1993	34	34	19472	Mean	-8.6	-167.8	-37.3	-31.1	37.1	-33.4	-0.294	-0.076
						Std	48.5	53.3	53.6	70.1	54.0	47.3	0.088	0.109
						Rms	49.3	176.0	65.3	76.7	65.5	57.9	0.306	0.133

D32-352	4161	1993	36	36	14042	Mean	-6.5	-228.9	-46.2	23.0	-46.8	-33.6	-0.387	-0.011
						Std	53.9	55.4	53.2	82.0	57.7	58.1	0.096	0.132
						Rms	54.3	235.5	70.5	82.1	74.3	67.1	0.399	0.132
	4162	1993	38	38	15688	Mean	-4.1	-206.0	-44.5	67.6	-67.3	-40.1	-0.340	0.059
						Std	64.3	43.8	63.6	65.2	62.9	54.6	0.077	0.105
						Rms	64.4	210.6	77.7	93.9	92.1	67.8	0.348	0.121
	4163	1993	40	40	13328	Mean	5.3	-218.8	-31.0	23.9	-43.5	-28.3	-0.352	0.054
						Std	49.4	50.4	51.5	79.1	62.4	53.8	0.083	0.099
						Rms	49.7	224.5	60.1	82.6	76.0	60.8	0.361	0.099
	4164	1993	42	42	19264	Mean	62.4	-198.9	39.9	145.3	-47.8	-40.6	-0.325	0.185
						Std	67.0	59.4	73.2	84.9	61.1	58.3	0.091	0.128
						Rms	91.5	207.5	83.3	168.3	77.6	71.0	0.338	0.225
	4165	1993	69	69	20844	Mean	-28.1	-136.9	-51.4	15.2	-34.2	-30.2	-0.240	-0.017
						Std	81.3	41.7	85.1	61.1	86.8	76.5	0.069	0.119
						Rms	86.0	143.1	99.4	63.0	93.3	82.3	0.250	0.120
D32-352	5114	1993	45	46	19562	Mean	-35.7	-216.4	-39.1	140.3	-60.7	-52.0	-0.325	0.197
						Std	64.0	48.1	61.3	86.5	57.5	57.9	0.075	0.115
						Rms	73.3	221.7	72.8	164.8	83.6	77.8	0.334	0.228
D32-353	1219	1993	145	146	17812	Mean	-15.0	11.5	-18.2	29.5	4.6	2.8	0.012	0.055
						Std	50.2	65.6	50.5	74.5	68.6	69.1	0.168	0.078
						Rms	52.4	66.6	53.7	80.2	68.7	69.2	0.169	0.095
	1220	1993	218	219	13331	Mean	-58.3	-144.9	-49.3	45.3	5.6	1.9	-0.320	-0.882
						Std	39.5	43.8	41.7	59.8	52.2	51.4	0.876	0.676
						Rms	70.3	151.4	64.6	75.0	52.5	51.5	0.332	0.111
	1221	1993	148	149	20058	Mean	-57.6	-128.7	-18.1	-34.6	-18.9	-23.1	-0.268	-0.061
						Std	29.0	47.0	30.2	59.0	28.5	29.2	0.090	0.116
						Rms	64.5	137.0	35.2	68.4	34.1	37.2	0.282	0.132
	1222	1993	151	152	18114	Mean	-26.2	-98.7	-7.3	20.3	-18.3	-22.6	-0.217	-0.032
						Std	43.3	43.3	43.0	43.5	40.6	40.7	0.091	0.082
						Rms	50.6	107.8	43.6	48.0	44.5	46.6	0.235	0.088
	1223	1993	220	220	13406	Mean	-83.7	-96.9	-51.5	4.2	-20.6	-20.1	-0.297	0.056
						Std	96.5	75.7	94.3	120.0	123.3	124.0	0.203	0.106
						Rms	127.8	122.9	107.4	120.0	124.6	125.6	0.360	0.120
	2062	1993	161	162	5864	Mean	32.5	-37.4	44.2	32.1	-11.7	-9.0	-0.109	0.115
						Std	59.6	39.4	54.4	70.8	68.8	69.2	0.246	0.119
						Rms	67.8	54.3	70.1	77.7	69.8	69.8	0.269	0.165
D32-353	2063	1993	154	155	17331	Mean	-141.5	-58.9	-114.0	25.4	-122.7	-127.9	-0.025	-0.079
						Std	46.2	29.5	42.5	92.1	62.7	59.8	0.088	0.121
						Rms	148.8	65.9	121.7	95.5	137.8	141.2	0.268	0.144

D32-353	2064	1993	157	158	17467	Mean	-47.7	-120.1	-19.5	-19.5	7.3	5.1	-0.338	-0.039
						Std	58.1	56.4	59.6	80.7	81.2	97.0	0.147	0.116
						Rms	75.2	132.7	62.7	83.0	81.6	97.1	0.369	0.122
	5115	1993	190	191	15481	Mean	-4.1	-198.4	11.3	-138.3	49.8	49.3	-0.316	-0.198
						Std	58.3	55.8	54.4	60.4	50.4	50.0	0.097	0.089
						Rms	58.4	206.1	55.6	151.0	70.9	70.2	0.331	0.217
	5117	1993	195	196	18748	Mean	40.8	-158.8	48.4	-41.2	71.5	69.2	-0.231	-0.043
						Std	55.9	46.4	53.0	102.9	56.6	57.5	0.074	0.127
						Rms	69.3	165.4	71.8	110.8	91.2	90.0	0.243	0.134
	5118	1993	200	200	18890	Mean	-6.2	-114.5	-4.7	67.3	8.4	6.4	-0.165	0.096
						Std	41.4	44.1	40.9	61.4	40.1	39.8	0.065	0.083
						Rms	41.8	122.7	41.1	91.1	41.0	40.3	0.177	0.127
	5119	1993	204	204	20168	Mean	4.8	-92.6	9.4	-110.6	71.8	69.2	-0.147	-0.103
						Std	59.2	54.0	58.0	67.0	45.5	45.1	0.082	0.080
						Rms	59.4	107.2	58.8	120.8	85.0	82.5	0.168	0.130
	5120	1993	208	208	16733	Mean	58.2	-85.1	56.9	22.8	28.4	27.4	-0.138	-0.062
						Std	61.9	70.0	61.1	84.3	68.5	68.2	0.119	0.098
						Rms	85.0	110.2	83.5	87.3	74.1	73.5	0.182	0.115
	5121	1993	211	211	18071	Mean	20.3	-94.8	24.1	-19.8	31.1	30.1	-0.200	-0.002
						Std	71.3	74.2	66.6	133.5	82.3	81.8	0.124	0.154
						Rms	74.1	120.3	70.8	134.9	88.0	87.2	0.203	0.154
	5122	1993	168	168	11853	Mean	42.6	-219.2	52.2	-105.9	66.4	62.1	-0.341	-0.156
						Std	50.0	35.5	49.1	91.9	59.0	61.5	0.057	0.109
						Rms	65.7	222.3	71.7	140.2	88.8	87.4	0.346	0.191
	5123	1993	164	165	16694	Mean	-77.5	-208.8	-36.1	-128.3	64.2	65.4	-0.456	-0.167
						Std	49.1	69.0	46.5	70.5	56.7	57.2	0.160	0.009
						Rms	91.8	220.0	58.9	146.4	85.7	86.9	0.483	0.188
	5124	1993	213	213	8671	Mean	32.4	-245.3	48.6	-130.1	81.4	81.2	-0.387	-0.178
						Std	44.1	35.7	40.5	65.3	41.7	42.7	0.051	0.081
						Rms	54.7	247.8	63.3	145.6	91.4	91.8	0.390	0.196
D32-353	5125	1993	185	186	17245	Mean	4.9	-249.0	16.3	-80.5	32.9	31.2	-0.409	-0.109
						Std	46.4	44.2	44.5	68.0	54.5	51.4	0.072	0.094
						Rms	46.6	252.9	47.3	105.3	63.6	60.2	0.415	0.144
D32-451	1224	1993	283	283	6179	Mean	-21.8	31.2	-18.6	53.7	37.8	38.4	0.072	0.047
						Std	61.8	78.2	63.9	60.7	62.5	63.0	0.189	0.071
						Rms	65.6	84.1	66.5	81.1	73.0	73.8	0.202	0.085
D32-451	1225	1993	287	287	15351	Mean	22.7	-86.5	7.6	4.5	35.9	35.2	-0.173	0.018
						Std	41.9	51.7	42.1	91.0	47.0	47.6	0.098	0.143
						Rms	47.7	100.8	42.7	91.1	59.1	59.2	0.199	0.144

D32-451	1226	1993	339	340	18094	Mean	12.6	-8.6	13.5	-47.6	-12.3	-2.3	-0.011	-0.074
						Std	48.3	41.2	49.8	66.6	32.6	31.8	0.076	0.122
						Rms	49.9	42.1	51.6	81.8	34.9	31.9	-0.076	0.143
	1227	1993	342	343	19098	Mean	-73.8	-65.1	-55.8	42.6	4.9	-0.5	-0.188	0.087
						Std	56.3	52.9	57.3	72.9	66.3	66.3	0.125	0.081
						Rms	92.8	83.9	80.0	84.4	66.4	66.3	0.226	0.119
	2066	1993	321	321	22306	Mean	-22.3	-20.7	-14.4	12.7	-16.6	-14.2	-0.063	-0.008
						Std	75.8	57.1	72.1	64.1	80.5	78.1	0.157	0.124
						Rms	79.1	60.7	73.5	65.3	82.2	79.3	0.169	0.124
	2067	1993	325	325	15166	Mean	-87.5	-27.1	-73.2	-14.9	-63.1	-55.7	-0.117	-0.064
						Std	57.3	42.9	61.7	57.8	60.0	55.8	0.074	0.131
						Rms	104.6	50.7	95.8	59.7	87.0	78.8	0.139	0.146
	2068	1993	326	327	16878	Mean	-85.3	-70.4	-58.2	22.4	-56.6	-46.2	-0.307	-0.017
						Std	63.9	78.8	77.0	93.2	104.1	109.8	0.222	0.134
						Rms	106.6	105.6	96.5	95.9	118.5	119.1	0.378	0.135
	2069	1993	330	331	19281	Mean	38.5	1.6	34.6	-69.3	77.2	80.4	0.090	0.001
						Std	59.6	55.4	55.5	97.4	99.2	99.7	0.304	0.112
						Rms	71.2	55.4	65.4	119.6	125.7	128.1	0.317	0.112
	2070	1993	333	334	19702	Mean	-53.5	-15.1	-44.2	75.4	-78.5	-76.6	-0.135	0.052
						Std	54.6	95.8	56.4	113.9	100.8	102.3	0.359	0.178
						Rms	76.4	97.0	71.7	136.6	127.8	127.8	0.384	0.185
	2071	1993	336	337	19294	Mean	-136.0	8.3	-132.9	29.1	-137.2	-138.6	-0.090	-0.061
						Std	82.1	54.6	83.0	84.1	92.7	82.5	0.115	0.139
						Rms	158.9	55.2	156.7	88.9	165.6	161.3	0.146	0.152
	3214	1993	307	307	14807	Mean	-15.4	-75.3	-145.0	82.8	21.7	15.8	-0.128	0.122
						Std	72.2	54.0	70.9	80.1	77.3	76.9	0.090	0.109
						Rms	73.8	92.7	72.4	115.2	80.3	78.5	0.156	0.163
	3215	1993	310	310	18540	Mean	-16.9	-112.2	-30.4	-22.6	-30.2	-31.8	-0.181	-0.043
						Std	63.5	53.5	61.2	94.8	60.6	59.9	0.085	0.154
						Rms	65.7	124.3	68.3	97.4	67.8	67.8	0.200	0.160
	3216	1993	313	313	15904	Mean	-28.5	-89.9	-44.1	-44.3	-33.7	-29.8	-0.142	-0.094
						Std	87.6	76.3	86.7	122.0	85.3	84.2	0.133	0.202
						Rms	92.1	117.9	97.3	129.8	91.7	89.3	0.195	0.223
	4166	1993	288	288	18469	Mean	-85.1	-45.7	-94.0	8.5	-78.0	-73.3	-0.046	-0.089
						Std	44.5	82.5	46.1	102.8	79.6	79.6	0.165	0.122
						Rms	96.0	94.3	104.7	103.2	111.4	108.2	0.171	0.151
D32-451	4167	1993	292	292	16833	Mean	-16.9	-29.4	24.2	7.7	-27.0	-31.0	-0.048	-0.021
						Std	96.6	97.3	99.3	214.8	192.0	191.7	0.200	0.226
						Rms	98.1	101.7	102.2	214.9	193.8	194.2	0.205	0.227

D32-451	4168	1993	295	295	18565	Mean	-23.3	-18.5	-69.1	10.9	-20.1	-17.4	2.597	-0.064
		Magnetic Pole Flight				Std	104.9	72.9	86.8	99.9	97.9	96.9	32.200	0.074
						Rms	107.4	75.2	110.9	100.4	99.9	98.5	32.300	0.098
	4169	1993	301	301	10633	Mean	-75.1	97.8	-46.9	16.2	-43.5	-44.3	0.224	-0.031
						Std	78.9	82.5	80.9	93.0	89.6	88.5	0.158	0.097
						Rms	108.9	127.9	93.5	94.4	99.6	99.0	0.274	0.101
	4170	1993	304	304	14948	Mean	-21.9	-90.9	-32.0	33.7	-32.0	-30.5	-0.136	0.023
						Std	73.2	55.4	72.9	86.3	72.5	66.8	0.094	0.136
						Rms	76.4	106.5	79.6	92.6	79.3	73.4	0.166	0.138
	4171	1993	316	316	13671	Mean	-74.6	-103.9	-98.1	-15.6	-69.4	-70.3	-0.166	-0.118
						Std	61.6	71.3	58.0	91.2	81.7	81.2	0.150	0.111
						Rms	96.8	126.0	114.0	92.5	107.2	107.5	0.224	0.162
D32-451	4172	1993	317	318	14505	Mean	-31.9	-19.7	-32.9	-31.4	-10.9	-14.5	-0.046	-0.081
						Std	48.6	61.1	47.8	89.9	78.5	77.5	0.155	0.131
						Rms	58.1	64.2	58.0	95.2	79.2	78.8	0.161	0.154

Table 7. WC-85 (updated) Model Coefficients

n	m	g_n^m	h_n^m	$\dot{g}_n^m$	$\dot{h}_n^m$
1	0	-29,874.2	0.0	19.3	0.0
1	1	-1,904.5	5,496.4	11.2	-17.9
2	0	-2,071.6	0.0	-12.6	0.0
2	1	3,045.7	-2,200.6	2.9	-16.1
2	2	1,688.7	-306.1	0.3	-13.8
3	0	1,294.7	0.0	3.8	0.0
3	1	-2,210.1	-306.4	-6.7	4.2
3	2	1,246.8	284.2	-0.4	1.9
3	3	832.4	-300.7	-5.1	-10.6
4	0	933.5	0.0	0.4	0.0
4	1	782.5	232.5	0.3	3.1
4	2	360.5	-247.6	-7.3	2.0
4	3	-424.2	72.2	0.4	3.5
4	4	166.0	-296.5	-5.9	-0.6
5	0	-212.3	0.0	0.1	0.0
5	1	354.0	43.7	-0.2	0.1
5	2	255.2	148.7	-1.5	0.8
5	3	-94.6	-154.6	-3.5	-0.3
5	4	-162.3	-76.2	0.0	1.5
5	5	-47.2	95.0	1.8	0.8
6	0	52.5	0.0	2.0	0.0
6	1	63.7	-14.7	0.0	0.0
6	2	51.0	88.6	1.6	-1.2
6	3	-185.4	70.0	1.3	0.1
6	4	3.8	-47.8	-0.3	-1.1
6	5	15.4	-1.4	0.1	0.5
6	6	-99.3	17.7	1.4	0.9
7	0	72.8	0.0	0.6	0.0
7	1	-59.7	-83.5	-0.7	0.6
7	2	1.3	-26.7	-0.1	0.2
7	3	25.1	-1.9	0.9	0.7
7	4	-4.8	19.9	1.4	-0.1
7	5	4.9	17.9	0.6	-0.3
7	6	10.1	-21.5	0.0	0.2
7	7	-0.8	-6.8	-0.1	-0.3
8	0	21.7	0.0	0.0	0.0
8	1	5.8	7.7	-0.4	0.6

Table 7. WC-85 (updated) Model Coefficients (Con.)

n	m	g_n^m	h_n^m	$\dot{g}_n^m$	$\dot{h}_n^m$
8	2	0.6	-18.3	-0.3	-0.2
8	3	-11.7	3.7	0.3	0.3
8	4	-11.0	-22.7	-0.6	0.4
8	5	2.2	10.8	-0.1	0.1
8	6	3.6	13.5	-0.2	-0.8
8	7	3.0	-15.4	-0.5	-0.6
8	8	-4.2	-9.1	-0.2	0.7
9	0	3.6	0.0	0.0	0.0
9	1	9.5	-21.9	0.0	0.0
9	2	-0.9	14.3	0.0	0.0
9	3	-10.7	9.5	0.0	0.0
9	4	10.7	-6.7	0.0	0.0
9	5	-3.2	-6.4	0.0	0.0
9	6	-1.4	9.1	0.0	0.0
9	7	6.3	8.9	0.0	0.0
9	8	0.8	-8.0	0.0	0.0
9	9	-5.5	2.1	0.0	0.0
10	0	-3.3	0.0	0.0	0.0
10	1	-2.6	2.6	0.0	0.0
10	2	4.5	1.2	0.0	0.0
10	3	-5.6	2.6	0.0	0.0
10	4	-3.6	5.7	0.0	0.0
10	5	3.9	-4.0	0.0	0.0
10	6	3.2	-0.4	0.0	0.0
10	7	1.7	-1.7	0.0	0.0
10	8	3.0	3.8	0.0	0.0
10	9	3.7	-0.8	0.0	0.0
10	10	0.7	-6.5	0.0	0.0
11	0	1.3	0.0	0.0	0.0
11	1	-1.4	0.0	0.0	0.0
11	2	-2.5	1.0	0.0	0.0
11	3	3.2	-1.6	0.0	0.0
11	4	0.2	-2.2	0.0	0.0
11	5	-1.1	1.1	0.0	0.0
11	6	0.3	-0.7	0.0	0.0
11	7	-0.3	-1.7	0.0	0.0
11	8	0.9	-1.5	0.0	0.0

Table 7. WC-85 (updated) Model Coefficients (Con.)

n	m	g_n^m	h_n^m	$\dot{g}_n^m$	$\dot{h}_n^m$
11	9	-1.1	-1.3	0.0	0.0
11	10	2.4	-1.1	0.0	0.0
11	11	3.0	0.6	0.0	0.0
12	0	-1.3	0.0	0.0	0.0
12	1	0.1	0.7	0.0	0.0
12	2	0.5	0.7	0.0	0.0
12	3	0.7	1.3	0.0	0.0
12	4	0.4	-1.5	0.0	0.0
12	5	-0.2	0.3	0.0	0.0
12	6	-1.1	0.2	0.0	0.0
12	7	0.9	-1.1	0.0	0.0
12	8	-0.6	1.2	0.0	0.0
12	9	0.8	-0.2	0.0	0.0
12	10	0.2	-1.3	0.0	0.0
12	11	0.4	0.6	0.0	0.0
12	12	0.2	0.6	0.0	0.0

Table 8. WMM-90 (modified) Model Coefficients

n	m	g_n^m	h_n^m	$\dot{g}_n^m$	$\dot{h}_n^m$
1	0	-29,777.7	0.0	19.1	0.0
1	1	-1,848.5	5,406.9	12.5	-17.9
2	0	-2,134.6	0.0	-13.4	0.0
2	1	3,060.2	-2,281.1	3.6	-14.9
2	2	1,690.2	-375.1	-0.1	-9.5
3	0	1,313.7	0.0	1.8	0.0
3	1	-2,243.6	-285.4	-7.0	4.1
3	2	1,244.8	293.7	-0.6	1.9
3	3	806.9	-353.7	-7.9	-12.0
4	0	935.5	0.0	0.8	0.0
4	1	784.0	248.0	0.7	2.0
4	2	324.0	-237.6	-6.7	1.4
4	3	-422.2	89.7	0.6	2.8
4	4	136.5	-299.5	-5.5	-1.3
5	0	-211.8	0.0	0.6	0.0
5	1	353.0	44.2	0.0	0.2
5	2	247.7	152.7	-1.1	0.9
5	3	-112.1	-156.1	-2.4	0.6
5	4	-162.3	-68.7	0.3	1.9
5	5	-38.2	99.0	2.5	1.0
6	0	62.5	0.0	1.2	0.0
6	1	63.7	-14.7	0.0	0.3
6	2	59.0	82.6	0.9	-1.4
6	3	-178.9	70.5	1.8	-0.2
6	4	2.3	-53.3	-0.3	-0.6
6	5	15.9	1.1	-0.2	0.8
6	6	-92.3	22.2	0.4	2.0
7	0	75.8	0.0	0.1	0.0
7	1	-63.2	-80.5	-0.9	0.5

Table 8. WMM-90 (modified) Model Coefficients (Con.)

n	m	g_n^m	h_n^m	$\dot{g}_n^m$	$\dot{h}_n^m$
7	2	0.8	-25.7	-0.6	0.3
7	3	29.6	1.6	0.6	0.5
7	4	2.2	19.4	0.9	-0.4
7	5	7.9	16.4	0.5	0.0
7	6	10.1	-20.5	0.1	-0.1
7	7	-1.3	-8.3	-0.7	-0.7
8	0	21.7	0.0	0.0	0.0
8	1	3.8	10.7	-0.4	0.5
8	2	-0.9	-19.3	-0.1	0.0
8	3	-10.2	5.2	0.2	0.2
8	4	-14.0	-20.7	-0.8	0.5
8	5	1.7	11.3	0.0	-0.1
8	6	2.6	9.5	0.0	-1.3
8	7	0.5	-18.4	-0.7	-0.2
8	8	-5.2	-5.6	-0.3	-0.7
9	0	3.6	0.0	0.0	0.0
9	1	9.5	-21.9	0.0	0.0
9	2	-0.9	14.3	0.0	0.0
9	3	-10.7	9.5	0.0	0.0
9	4	10.7	-6.7	0.0	0.0
9	5	-3.2	-6.4	0.0	0.0
9	6	-1.4	9.1	0.0	0.0
9	7	6.3	8.9	0.0	0.0
9	8	0.8	-8.0	0.0	0.0
9	9	-5.5	2.1	0.0	0.0
10	0	-3.3	0.0	0.0	0.0
10	1	-2.6	2.6	0.0	0.0
10	2	4.5	1.2	0.0	0.0
10	3	-5.6	2.6	0.0	0.0
10	4	-3.6	5.7	0.0	0.0
10	5	3.9	-4.0	0.0	0.0
10	6	3.2	-0.4	0.0	0.0
10	7	1.7	-1.7	0.0	0.0
10	8	3.0	3.8	0.0	0.0
10	9	3.7	-0.8	0.0	0.0
10	10	0.7	-6.5	0.0	0.0

Table 8. WMM-90 (modified) Model Coefficients (Con.)

n	m	g_n^m	h_n^m	$\dot{g}_n^m$	$\dot{h}_n^m$
11	0	1.3	0.0	0.0	0.0
11	1	-1.4	0.0	0.0	0.0
11	2	-2.5	1.0	0.0	0.0
11	3	3.2	-1.6	0.0	0.0
11	4	0.2	-2.2	0.0	0.0
11	5	-1.1	1.1	0.0	0.0
11	6	0.3	-0.7	0.0	0.0
11	7	-0.3	-1.7	0.0	0.0
11	8	0.9	-1.5	0.0	0.0
11	9	-1.1	-1.3	0.0	0.0
11	10	2.4	-1.1	0.0	0.0
11	11	3.0	0.6	0.0	0.0
12	0	-1.3	0.0	0.0	0.0
12	1	0.1	0.7	0.0	0.0
12	2	0.5	0.7	0.0	0.0
12	3	0.7	1.3	0.0	0.0
12	4	0.4	-1.5	0.0	0.0
12	5	-0.2	0.3	0.0	0.0
12	6	-1.1	0.2	0.0	0.0
12	7	0.9	-1.1	0.0	0.0
12	8	-0.6	1.2	0.0	0.0
12	9	0.8	-0.2	0.0	0.0
12	10	0.2	-1.3	0.0	0.0
12	11	0.4	0.6	0.0	0.0
12	12	0.2	0.6	0.0	0.0

Variation (DV). Otherwise no DV corrections were made. The flights are generally of long range over remote ocean areas, which precludes the monitoring of DV. Each flight typically lasts 10 to 12 hours and is flown at an average speed of about 440 km/hr. A low-pass filter with a cutoff wavelength of 7 km is routinely applied to Project MAGNET survey data collected at altitudes greater than 15,000 feet. The Honeywell vector magnetometer is calibrated at least once a year at the National Aeronautics and Space Administration's (NASA's) Coil Room Facility in Greenbelt, Maryland.

These Project MAGNET survey data sets were collected primarily in ocean areas straddling the geomagnetic equator with the intent to provide absolute vector-magnetic measurements in the equatorial region to counter the Backus effect (also known as the Perpendicular Error effect). This effect is a spherical-harmonic modeling error that generates spurious magnetic anomalies along the geomagnetic equator if only scalar Total-Magnetic-Intensity measurements are available for the modeling. Flights were also made to the North and South Magnetic Poles in order to supply data to pin down the geomagnetic pole positions.

2.2.3 POGS Data

The POGS satellite was launched April 11, 1990. The salient design characteristics, processing procedures, and calibrations applied are given by Quinn et al. (1993). The satellite was inserted into a near circular, polar orbit ranging in altitude between 700 km and 750 km. The orbit was not sun-synchronous and so, covered all local times. The fluxgate vector magnetometer was located at the tip of an 8-ft. non-magnetic Copper-Beryllium boom and had a resolution of 2 nT per vector axis. Although the satellite carried a vector magnetometer, there was essentially no attitude determination system on the satellite to orient the magnetometer. We say *essentially* no attitude determination system because a coarse attitude device was constructed from 9 of the 52 solar panels, which provided some attitude for the satellite (but not the boom-mounted magnetometer relative to the satellite) with respect to the sun-line. However, the accuracy of this system was at best only $\pm 3^0$ with degrading accuracy as the satellite approached the dawn-dusk meridian. So, the solar panels were used as a coarse sun-sensor which provided no data on the night side of the Earth. Consequently, the POGS mission was essentially a scalar magnetic survey of the Earth. The attitude data were nevertheless made available, since applications other than world magnetic modeling may find it useful.

The POGS satellite mission carried a fluxgate vector magnetometer. These magnetometers are not *absolute* instruments and so, have a tendency to drift. Extra thermal mass was added to the magnetometer to minimize this drift. Even so, it was estimated at the time of launch that the magnetometer drift could be as much as 50 nT/yr. Additionally, the quartz clock on the satellite, to which the magnetics data are time tagged prior to being telemetered back to a ground station, also has a tendency to drift. If not properly taken into account, both of these drifts can be misinterpreted as SV.

The POGS quartz clock bias and drift were determined by periodically monitoring the POGS clock via scheduled timing pulses sent from the satellite to the Master Ground station located at NAVOCEANO, which was equipped with a cesium standard clock calibrated at the Naval

Observatory. The pulse was of known duration (20 seconds). The difference between the scheduled end of the pulse, which was known *a priori*, and the actual end of the pulse, accounting for the time taken to travel the distance between the satellite and the ground station, yielded the POGS quartz-clock timing error, which could be measured to within 10 milliseconds. Repeating this procedure at roughly 10-day intervals during the 1991.0 to 1993.7 time frame yielded the POGS quartz clock bias and drift rates indicated by Quinn et al. (1993). The time-corrected magnetics data could then be properly merged with the ephemeris data supplied by DMA. The ephemeris data were generated from Doppler-tracking data collected from DMA's Tracking Network (TRANET), which monitored the emissions from two beacons of different frequencies, which were located onboard the POGS satellite. The satellite ephemeris was reconstructed using the GEM-10B gravity model. The resulting satellite positioning Spherical Error Probable (SEP) was estimated to be less than 75 meters by DMA. The TRANET stations were dismantled in October 1993. This event effectively ended the POGS mission of magnetic data collection for world magnetic modeling purposes.

The POGS magnetometer bias and drift were determined by selecting the Solar quiet-time POGS Total Intensity data over the European area bounded by 40^0 N and 60^0 N and by 5^0 W and 35^0 E, correcting for external field effects, subsequently removing the Total Intensity as computed from the WMM-90 (modified) model, and minimizing the residual with respect to the bias and drift coefficients of a linear drift model via least squares. The main assumption in this procedure is that the WMM-90 (modified) model, which is based on the most recent available magnetic observatory annual-means data as of May 1994, is extremely accurate over the European area due to the substantial clustering of Magnetic Observatories in the region. During the course of estimating the magnetometer bias and drift coefficients, it was determined that for a short segment of data between 1991.0 and 1991.4 the timing pulse corrections were incorrectly applied. So, the method used to compute the scalar magnetic bias and drift coefficients for the magnetometer was also used to generate an additional magnetic correction to compensate for the timing-pulse problem. The linear drift corrections thus determined take the following forms:

a. Magnetic Compensation for Clock Drift Errors:

$$\Delta B_c = b_c + \dot{b}_c (t - \tau_c) \qquad 1991.0 \leq t \leq 1991.4 \tag{29}$$

where the reference time in years is:

$$\tau_c = 1991.175394115 \tag{30}$$

and where the bias and drift rates are:

$$b_c = -18.783 \text{ nT} \tag{31a}$$

$$\dot{b}_c = 144.338 \text{ nT/yr} \tag{31b}$$

b. Magnetic Correction for Magnetometer Drift:

$$\Delta B_M = b_M + \dot{b}(t - \tau_M) \qquad 1991.0 \le t \le 1993.7 \tag{32}$$

where the reference time in years is:

$$\tau_M = 1992.506748293 \tag{33}$$

and where the bias and drift rates are:

$$b_M = \quad 11.620 \text{ nT} \tag{34a}$$

$$\dot{b}_M = -16.167 \text{ nT/yr} \tag{34b}$$

These two corrections are illustrated in figure 5. When these corrections are applied to the POGS data (i.e., subtracted from the POGS Total Intensity data), then the POGS data are considered as having been *Ground Truthed* and are thus considered to be *absolute* measurements. It should be noted here that the POGS data available from NGDC do *not* include these corrections. The POGS 10-day file statistics with these drift corrections applied are given in table 9. They have been computed with respect to the WMM-90 (modified) model.

The ionospheric/magnetospheric field contributions to the POGS data were considerably larger than the magnetometer drift corrections even though the quiet-time selection criteria previously given in the Overview was employed. Given the altitude of the satellite (about 725 km), the ionospheric portion of the magnetic field measured by POGS was *tentatively* attributed to equatorial and mid-latitude *Spread-F effects* (Kelley [1989]). This is a phenomenon occurring in the *F-layer* of the ionosphere. In extremely quiet times, this field was limited to the equatorial region. During these times the phenomenon is referred to as the *equatorial* Spread-F effect. Frequently, the Spread-F effect was prominent both at mid-latitudes and at high-latitudes and exhibits an interesting latitudinal banding effect. The number and magnetic intensity of these bands depends on the amount of energy, as measured by the Kp index, being dumped into the ionosphere as a consequence of solar activity.

Detailed analyses of the POGS data with respect to ionospheric and magnetospheric effects could take years. For the WMM-95 modeling effort it was necessary only to identify and remove fields of external origin. To isolate that portion of the observed field due to this *presumed* Spread-F effect, magnetic field models were generated from the POGS data at the 14 epochs corresponding to the 14 groups of quiet-time POGS data selected for modeling use. The groups of 10-day POGS files selected for each model are listed in table 10. Vector data from the WMM-90 (modified) model were inserted in an equatorial band straddling $\pm 20^0$ about the geomagnetic equator to control the Backus effect, while POGS data were used exclusively outside of this band. Except for equal area weighting, no weights were applied. Internal Gauss coefficients up to degree and order 12 and external Gauss coefficients up to degree and order 5 were computed at each of the 14 epochs. That is, 14 models were generated at 14 distinct epochs. Scalar Total Intensity field values computed from these models, using both internal and

POGS MAGNETOMETER AND CLOCK BIAS & DRIFT CORRECTIONS (nT)

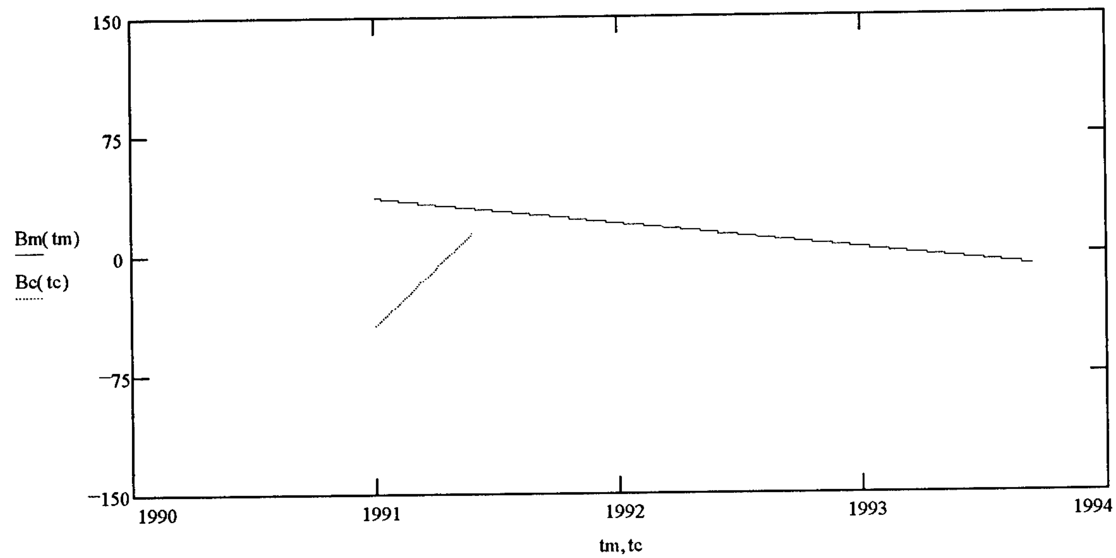


Figure 5. POGS Total Intensity Drift Corrections: Magnetometer & Clock

Table 9. POGS 10-DAY FILE STATISTICS
wrt. WMM-90 (modified)

|Dst| < 50　　Kp < 2+　　7 pm < Local Time < 5 am

File	Year	Day Begin	Day End	Records		Bfv (nT)	Used in Model #s
pogs1011020.dst	1991	11	20	10210	Mean	15.0	1
					Std	42.6	
					Rms	45.1	
pogs1021030.dst	1991	21	30	8491	Mean	19.2	1 & 2
					Std	51.4	
					Rms	54.8	
pogs1031040.dst	1991	31	40	4262	Mean	14.0	2
					Std	50.1	
					Rms	52.0	
pogs1041050.dst	1991	41	50	5701	Mean	22.0	2 & 3
					Std	49.1	
					Rms	53.8	
pogs1051060.dst	1991	51	60	11914	Mean	20.8	3
					Std	42.5	
					Rms	47.3	
pogs1061070.dst	1991	61	70	3572	Mean	11.3	
					Std	60.5	
					Rms	61.6	
pogs1071080.dst	1991	71	80	5181	Mean	23.2	
					Std	59.3	
					Rms	63.7	
pogs1081090.dst	1991	81	90	2183	Mean	5.9	
					Std	64.2	
					Rms	64.4	
pogs1091100.dst	1991	91	100	790	Mean	20.0	
					Std	55.8	
					Rms	59.2	
pogs1101110.dst	1991	101	110	56	Mean	-7.6	
					Std	18.5	
					Rms	19.9	
pogs1111120.dst	1991	111	120	17	Mean	-2.3	
					Std	22.4	
					Rms	21.9	
pogs1121130.dst	1991	121	130	3669	Mean	37.4	4
					Std	37.6	
					Rms	53.0	
pogs1131140.dst	1991	131	140	8686	Mean	30.5	4
					Std	37.5	
					Rms	48.3	
pogs1141150.dst	1991	141	150	1634	Mean	10.7	4
					Std	41.5	
					Rms	42.9	
pogs1151160.dst	1991	151	160	365	Mean	-27.5	4
					Std	41.9	
					Rms	50.1	
pogs1161170.dst	1991	161	170	1977	Mean	12.1	4 & 5
					Std	41.5	
					Rms	43.2	

pogs1171180.dst	1991	171	180	3938	Mean	24.5	4 & 5
					Std	43.0	
					Rms	49.5	
pogs1181190.dst	1991	181	190	3157	Mean	28.3	5
					Std	39.4	
					Rms	48.5	
pogs1191200.dst	1991	191	200	0	Mean	0.0	5
					Std	0.0	
					Rms	0.0	
pogs1201210.dst	1991	201	210	3651	Mean	25.7	5
					Std	38.5	
					Rms	46.3	
pogs1211220.dst	1991	211	220	3966	Mean	33.9	5
					Std	31.0	
					Rms	45.9	
pogs1221230.dst	1991	221	230	1243	Mean	11.6	5
					Std	35.0	
					Rms	36.9	
pogs1231240.dst	1991	231	240	3079	Mean	24.3	6
					Std	37.0	
					Rms	44.2	
pogs1241250.dst	1991	241	250	2773	Mean	19.2	6
					Std	41.5	
					Rms	45.7	
pogs1251260.dst	1991	251	260	3483	Mean	29.6	6
					Std	36.7	
					Rms	47.2	
pogs1261270.dst	1991	261	270	8956	Mean	29.7	6
					Std	35.0	
					Rms	45.9	
pogs1271280.dst	1991	271	280	0	Mean	0.0	
					Std	0.0	
					Rms	0.0	
pogs1281290.dst	1991	281	290	5	Mean	60.9	
					Std	6.6	
					Rms	61.2	
pogs1291300.dst	1991	291	300	10	Mean	66.2	
					Std	18.9	
					Rms	68.5	
pogs1301310.dst	1991	301	310	296	Mean	8.5	
					Std	39.3	
					Rms	40.1	
pogs1311320.dst	1991	311	320	1208	Mean	39.4	
					Std	41.6	
					Rms	57.3	
pogs1321330.dst	1991	321	330	1630	Mean	13.6	
					Std	38.3	
					Rms	40.6	
pogs1331340.dst	1991	331	340	6138	Mean	25.4	
					Std	36.7	
					Rms	44.7	
pogs1341350.dst	1991	341	350	2874	Mean	24.4	
					Std	35.7	
					Rms	43.2	

pogs1351360.dst	1991	351	360	985	Mean	17.5	
					Std	37.3	
					Rms	41.2	
pogs1361365.dst	1991	361	365	390	Mean	-3.4	
					Std	47.8	
					Rms	47.9	
pogs2001010.dst	1992	1	10	4805	Mean	22.3	7
					Std	40.9	
					Rms	46.6	
pogs2011020.dst	1992	11	20	4186	Mean	18.9	7
					Std	33.6	
					Rms	50.9	
pogs2021030.dst	1992	21	30	6657	Mean	35.6	7
					Std	32.1	
					Rms	48.0	
pogs2031040.dst	1992	31	40	779	Mean	5.5	7
					Std	43.4	
					Rms	43.7	
pogs2041050.dst	1992	41	50	5698	Mean	16.7	7
					Std	33.4	
					Rms	37.4	
pogs2051060.dst	1992	51	60	0	Mean	0.0	
					Std	0.0	
					Rms	0.0	
pogs2061070.dst	1992	61	70	840	Mean	-0.9	
					Std	49.0	
					Rms	48.9	
pogs2071080.dst	1992	71	80	4528	Mean	19.0	
					Std	41.8	
					Rms	45.9	
pogs2081090.dst	1992	81	90	861	Mean	14.8	
					Std	43.0	
					Rms	45.5	
pogs2091100.dst	1992	91	100	590	Mean	16.2	
					Std	33.3	
					Rms	37.0	
pogs2101110.dst	1992	101	110	45	Mean	-14.5	
					Std	14.6	
					Rms	20.4	
pogs2111120.dst	1992	111	120	0	Mean	0.0	
					Std	0.0	
					Rms	0.0	
pogs2121130.dst	1992	121	130	8962	Mean	26.6	8
					Std	36.6	
					Rms	45.2	
pogs2131140.dst	1992	131	140	4405	Mean	13.5	8
					Std	36.9	
					Rms	39.3	
pogs2141150.dst	1992	141	150	3661	Mean	21.5	8
					Std	38.6	
					Rms	44.2	
pogs2151160.dst	1992	151	160	8948	Mean	28.7	9
					Std	35.2	
					Rms	45.5	

pogs2161170.dst	1992	161	170	3931	Mean	26.5	9
					Std	33.0	
					Rms	42.3	
pogs2171180.dst	1992	171	180	5656	Mean	14.9	9
					Std	46.9	
					Rms	49.2	
pogs2181190.dst	1992	181	190	9641	Mean	8.4	10
					Std	33.5	
					Rms	34.5	
pogs2191200.dst	1992	191	200	7106	Mean	16.7	10
					Std	32.4	
					Rms	36.5	
pogs2201210.dst	1992	201	210	4203	Mean	30.3	10
					Std	31.9	
					Rms	44.0	
pogs2211220.dst	1992	211	220	5146	Mean	19.3	11
					Std	37.8	
					Rms	42.4	
pogs2221230.dst	1992	221	230	3916	Mean	6.7	11
					Std	35.2	
					Rms	35.8	
pogs2231240.dst	1992	231	240	6311	Mean	21.6	11
					Std	31.5	
					Rms	38.2	
pogs2241250.dst	1992	241	250	6626	Mean	11.4	11
					Std	33.9	
					Rms	35.8	
pogs3001010.dst	1993	1	10	2350	Mean	20.5	
					Std	57.8	
					Rms	61.3	
pogs3011020.dst	1993	11	20	2805	Mean	11.0	
					Std	53.1	
					Rms	54.2	
pogs3021030.dst	1993	21	30	7614	Mean	21.0	12
					Std	57.5	
					Rms	61.2	
pogs3031040.dst	1993	31	40	4286	Mean	15.8	12
					Std	37.1	
					Rms	40.3	
pogs3041050.dst	1993	41	50	7273	Mean	8.4	12
					Std	33.6	
					Rms	34.7	
pogs3051060.dst	1993	51	60	3529	Mean	12.4	
					Std	31.9	
					Rms	34.2	
pogs3061070.dst	1993	61	70	290	Mean	-1.1	
					Std	26.6	
					Rms	26.6	
pogs3071080.dst	1993	71	80	1071	Mean	14.2	
					Std	33.2	
					Rms	36.1	
pogs3081090.dst	1993	81	90	748	Mean	-5.7	
					Std	24.4	
					Rms	25.1	

pogs3091100.dst	1993	91	100	0	Mean	0.0	
					Std	0.0	
					Rms	0.0	
pogs3101110.dst	1993	101	110	0	Mean	0.0	
					Std	0.0	
					Rms	0.0	
pogs3111120.dst	1993	111	120	2872	Mean	22.6	
					Std	34.8	
					Rms	41.5	
pogs3121130.dst	1993	121	130	10756	Mean	21.2	13
					Std	33.1	
					Rms	39.3	
pogs3131140.dst	1993	131	140	3326	Mean	6.2	13
					Std	38.5	
					Rms	39.0	
pogs3141150.dst	1993	141	150	11751	Mean	20.9	13
					Std	38.1	
					Rms	43.5	
pogs3151160.dst	1993	151	160	0	Mean	0.0	
					Std	0.0	
					Rms	0.0	
pogs3161170.dst	1993	161	170	431	Mean	3.1	
					Std	38.2	
					Rms	38.2	
pogs3171180.dst	1993	171	180	3474	Mean	23.1	14
					Std	42.6	
					Rms	48.4	
pogs3181190.dst	1993	181	190	2839	Mean	14.4	14
					Std	38.0	
					Rms	40.7	
pogs3191200.dst	1993	191	200	9214	Mean	4.8	14
					Std	43.7	
					Rms	44.0	
pogs3201210.dst	1993	201	210	5315	Mean	6.5	14
					Std	40.9	
					Rms	41.4	
pogs3211220.dst	1993	211	220	906	Mean	17.3	
					Std	40.2	
					Rms	43.8	

Table 10. **WORLD MAGNETIC MODELS BASED ON POGS DATA**

Model #	Year	Mean Day	Mean Epoch	Pogs Data Files	Pogs File Mean Day	Records	Pogs Merge Files	Total Records
1	1991	19.459	1991.053311406	pogs1011020.dst	15.074	10210	pogs1011030.mrg	18701
				pogs1021030.dst	24.731	8491		
2	1991	33.544	1991.091901159	pogs1021030.dst	24.731	8491	pogs1021050.mrg	18454
				pogs1031040.dst	34.649	4262		
				pogs1041050.dst	45.844	5701		
3	1991	52.310	1991.143315328	pogs1041050.dst	45.844	5701	pogs1041060.mrg	17615
				pogs1051060.dst	55.404	11914		
4	1991	147.598	1991.404376920	pogs1121130.dst	128.899	3669	pogs1121180.mrg	20269
				pogs1131140.dst	136.317	8686		
				pogs1141150.dst	147.629	1634		
				pogs1151160.dst	154.463	365		
				pogs1161170.dst	167.488	1977		
				pogs1171180.dst	179.264	3938		
5	1991	196.089	1991.537230610	pogs1161170.dst	167.488	1977	pogs1161230.mrg	17932
				pogs1171180.dst	179.264	3938		
				pogs1181190.dst	186.418	3157		
				pogs1201210.dst	207.935	3651		
				pogs1211220.dst	214.186	3966		
				pogs1221230.dst	226.911	1243		
6	1991	256.407	1991.702486157	pogs1231240.dst	237.986	3079	pogs1231270.mrg	18291
				pogs1241250.dst	246.413	2773		
				pogs1251260.dst	259.230	3483		
				pogs1261270.dst	264.737	8956		
7	1992	25.353	1992.069269918	pogs2001010.dst	5.241	4805	pogs2001050.mrg	22125
				pogs2011020.dst	18.923	4186		
				pogs2021030.dst	24.218	6657		
				pogs2031040.dst	37.922	779		
				pogs2041050.dst	46.643	5698		
8	1992	133.341	1992.364319170	pogs2121130.dst	125.297	8692	pogs2121150.mrg	16758
				pogs2131140.dst	138.306	4405		
				pogs2141150.dst	147.058	3661		
9	1992	165.201	1992.451370167	pogs2151160.dst	155.542	8948	pogs2151180.mrg	18535
				pogs2161170.dst	168.831	3931		
				pogs2171180.dst	177.962	5656		
10	1992	194.009	1992.530078330	pogs2181190.dst	187.465	9641	pogs2181210.mrg	20950
				pogs2191200.dst	194.903	7106		
				pogs2201210.dst	207.507	4203		

11	1992	230.815	1992.630642692	pogs2211220.dst	213.942	5146	pogs2211250.mrg	21999
				pogs2221230.dst	223.674	3916		
				pogs2231240.dst	235.400	6311		
				pogs2241250.dst	243.773	6626		
12	1993	35.275	1993.096644405	pogs3021030.dst	24.489	7614	pogs3021050.mrg	19173
				pogs3031040.dst	39.951	4286		
				pogs3041050.dst	46.170	7273		
13	1993	135.370	1993.370875815	pogs3121130.dst	124.267	10756	pogs3121150.mrg	25833
				pogs3131140.dst	134.968	3326		
				pogs3141150.dst	145.649	11751		
14	1993	193.268	1993.529501624	pogs3171180.dst	174.682	3912	pogs3171210.mrg	21584
				pogs3181190.dst	188.038	3055		
				pogs3191200.dst	195.762	9600		
				pogs3201210.dst	203.681	5017		

external parts, were then subtracted from the Total Intensity data of the 10-day POGS files, creating Total Intensity Residual files for each 10-day period. Each 10-day Residual file was averaged over all Geomagnetic Longitudes for each 1^0 Geomagnetic Latitude band, yielding an estimated external field correction profile for each 10-day file as a function of Geomagnetic Latitude.

Figures 6 through 19 exhibit sample external field correction profiles corresponding to specific 10-day POGS data files. One file has been selected from each of the 14 modeling groups listed in table 10. They span the 1991.0 to 1993.7 time frame. Rotating these profiles through 360^0 of longitude and transforming back to geodetic coordinates yields charts (47) through (60), which display a global, 10-day average picture of the mainly Ionospheric corrections. This procedure may also remove residual magnetospheric effects as well. These figures and charts exhibit the high degree of temporal variability that is clearly external in origin.

Magnetic fields of crustal origin are not resolved in the POGS data primarily because of the satellite's altitude which is nearly twice that of the 1979-1980 MAGSAT satellite mission. In unusually quite periods, as exemplified by charts 47, 48, 49, 54, 59, and 60, substantial magnetic activity associated with Field-Aligned currents can still be seen in the auroral zones, while pronounced equatorial Spread-F effects are clearly defined along the geomagnetic equator. The POGS satellite's altitude (about 725 km) also precludes the possibility of interpreting the observed external equatorial field as being due to the Equatorial Electrojet (EE). This is in contrast to the MAGSAT mission (about 400 km), which did encounter EE effects (Langel et al., 1993b).

Charts 47 and 54 make an interesting contrast. The external fields are generally quiet for both, but the activity along the equatorial zone has moved from the southern geomagnetic hemisphere to the northern geomagnetic hemisphere. This effect is apparently associated with a change in direction of the *Interplanetary Magnetic Field* (IMF) from its usual southward direction to a northerly one. Some more disturbed 10-day periods exemplified by charts 50 and 51 exhibit substantial magnetic activity at both mid-latitudes and high-latitudes. Charts 52 and 53 and charts 55 through 58 correspond to somewhat less disturbed 10-day periods and prominently illustrate varying degrees of low-latitude and mid-latitude banding.

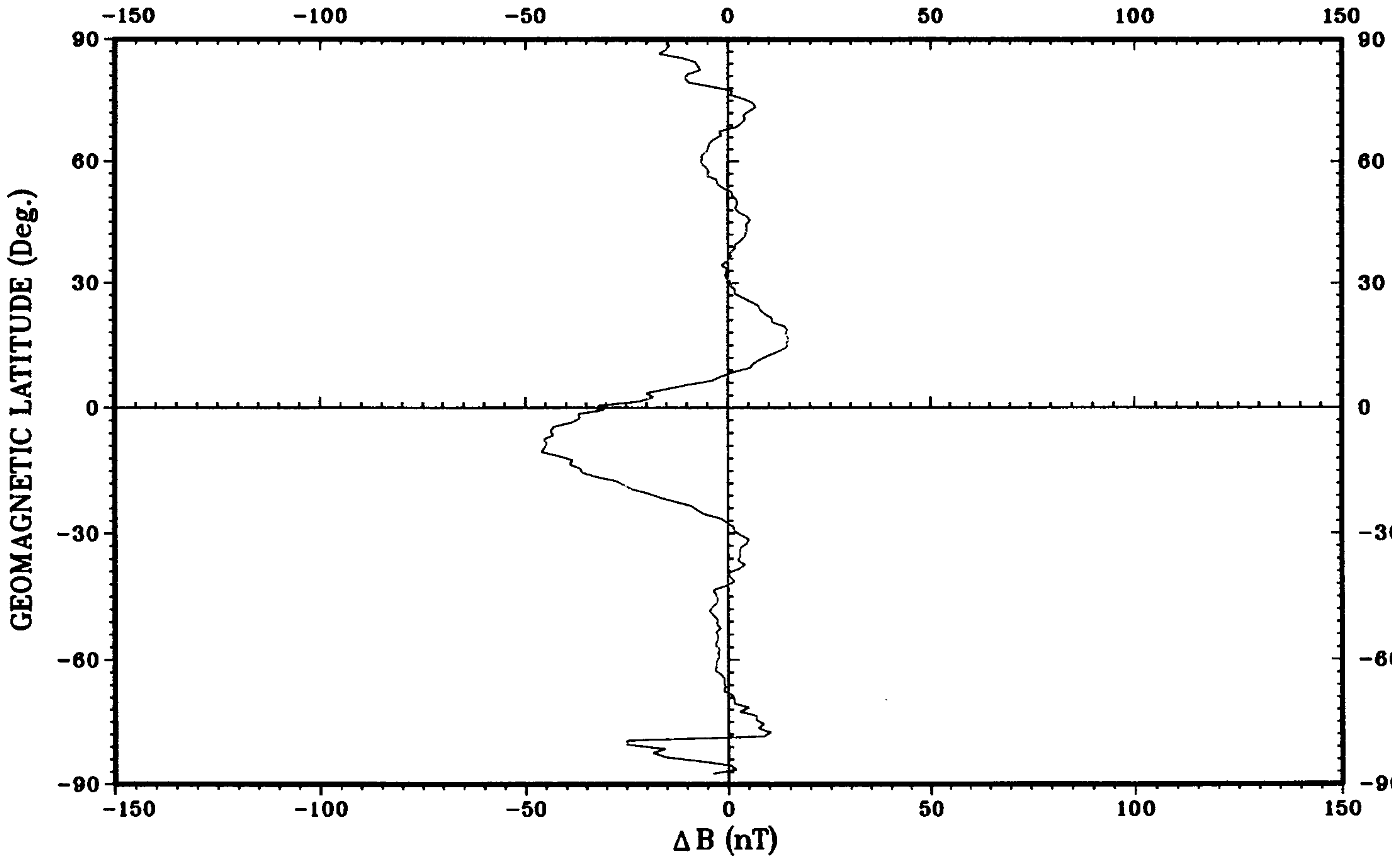
2.3 Weight Factors

The modeling procedure employed was a modification of that formulated by Cain et al. (1967). The objective was to minimize the chi-square (χ^2) function:

$$\chi^2 = \chi_r^2 + \chi_\theta^2 + \chi_\varphi^2 + \chi_F^2 \tag{35}$$

with respect to 168 MF (i.e., internal) Gauss coefficients corresponding to a degree and order 12 spherical-harmonic model, 35 external-field Gauss coefficients corresponding to a degree and order 5 spherical harmonic model and 3 additional External-Gauss coefficients corresponding to a degree and order 1 spherical-harmonic model, which accounts for residual Ring-current

IONOSPHERIC CORRECTION



File = pogs1011020.dst
Model = c-mdl_01.cof
Kp Max = 2.667

|Dst| ≤ 50.0 nT
Begin Local Time = 19.0 Hrs
End Local Time = 5.0 Hrs

Figure 6. POGS Total Intensity Ionospheric-Field Correction: 1991, Days 011 - 020

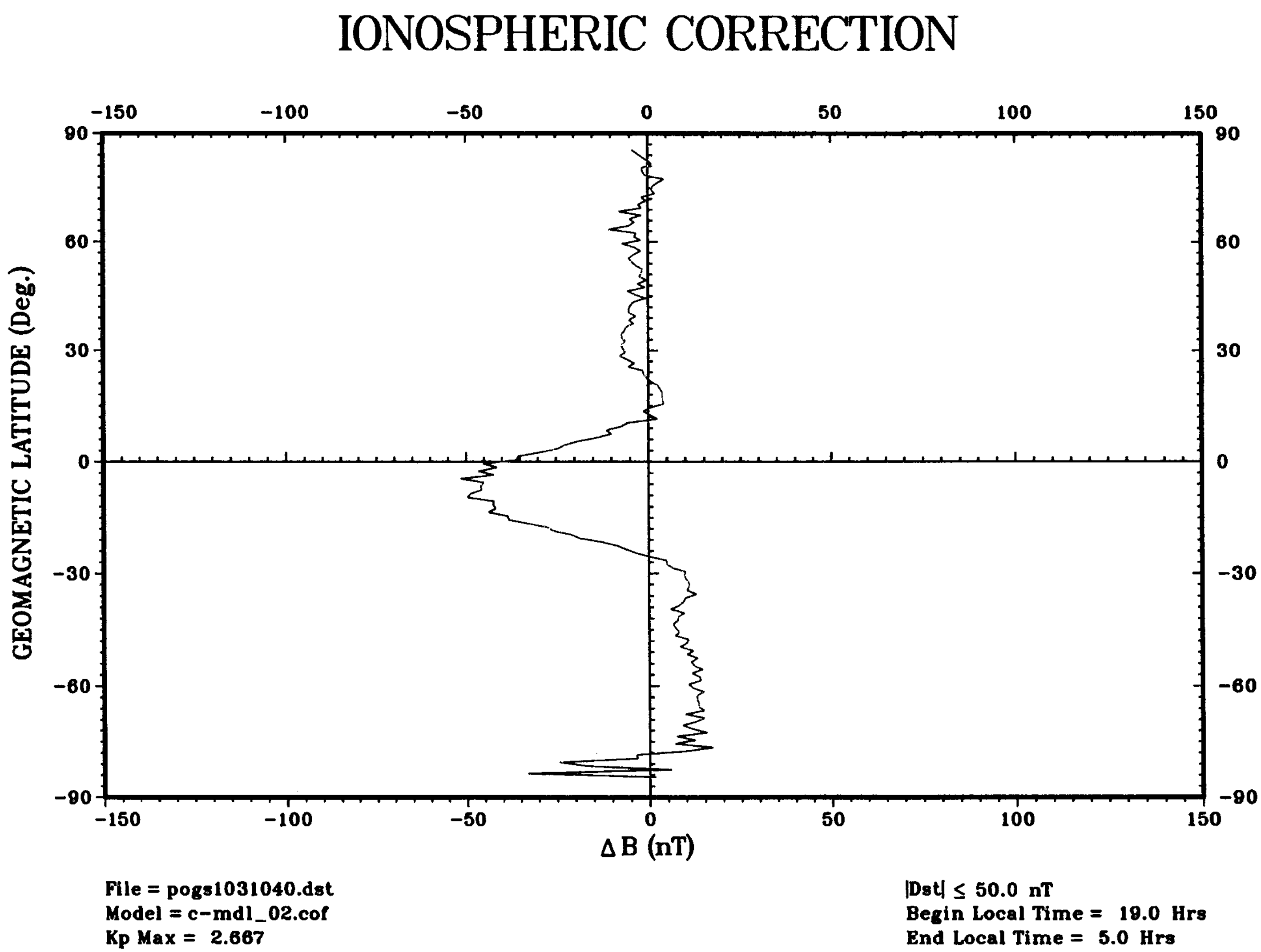


Figure 7. POGS Total Intensity Ionospheric-Field Correction: 1991, Days 031 - 040

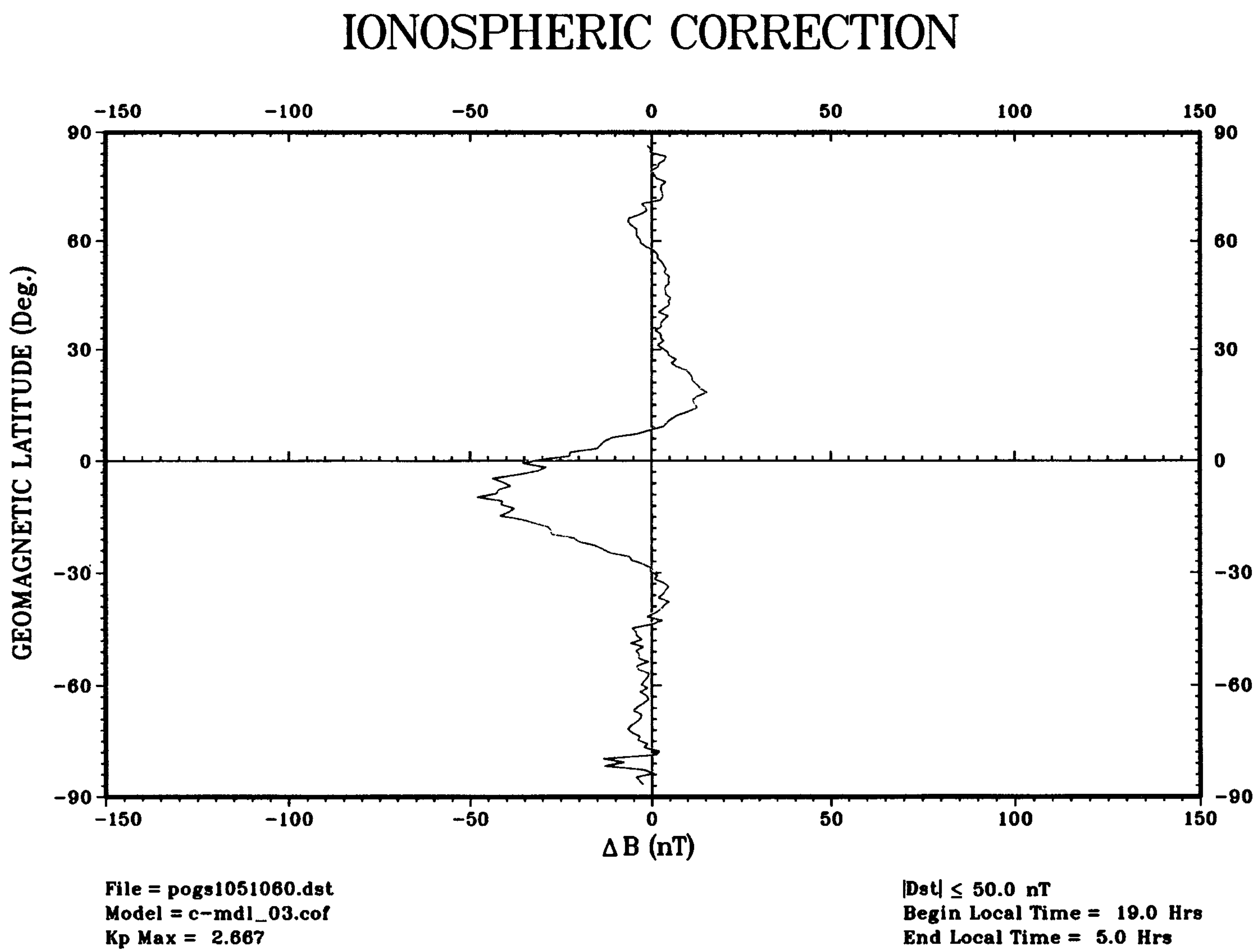


Figure 8. POGS Total Intensity Ionospheric-Field Correction: 1991, Days 051 - 060

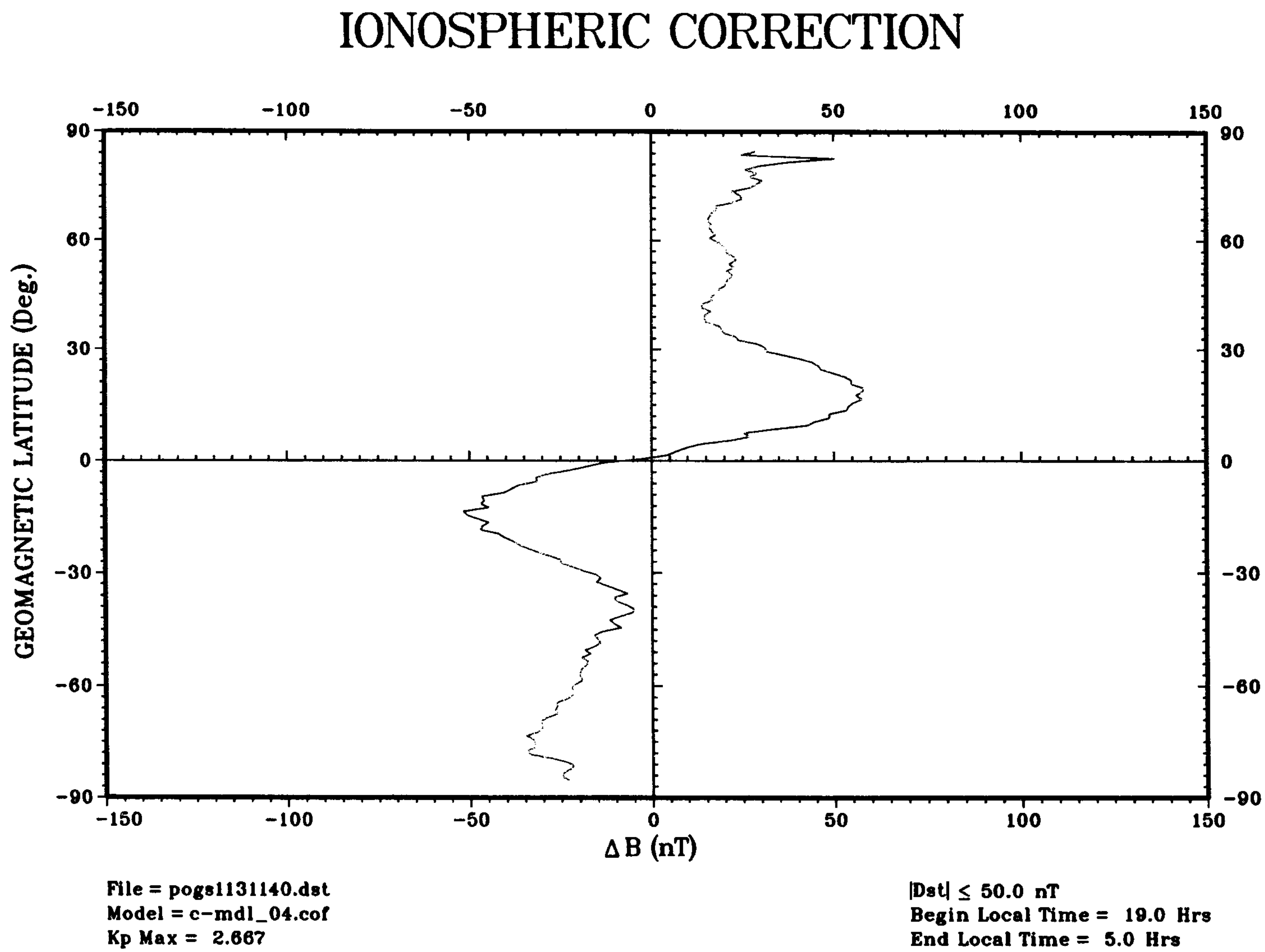
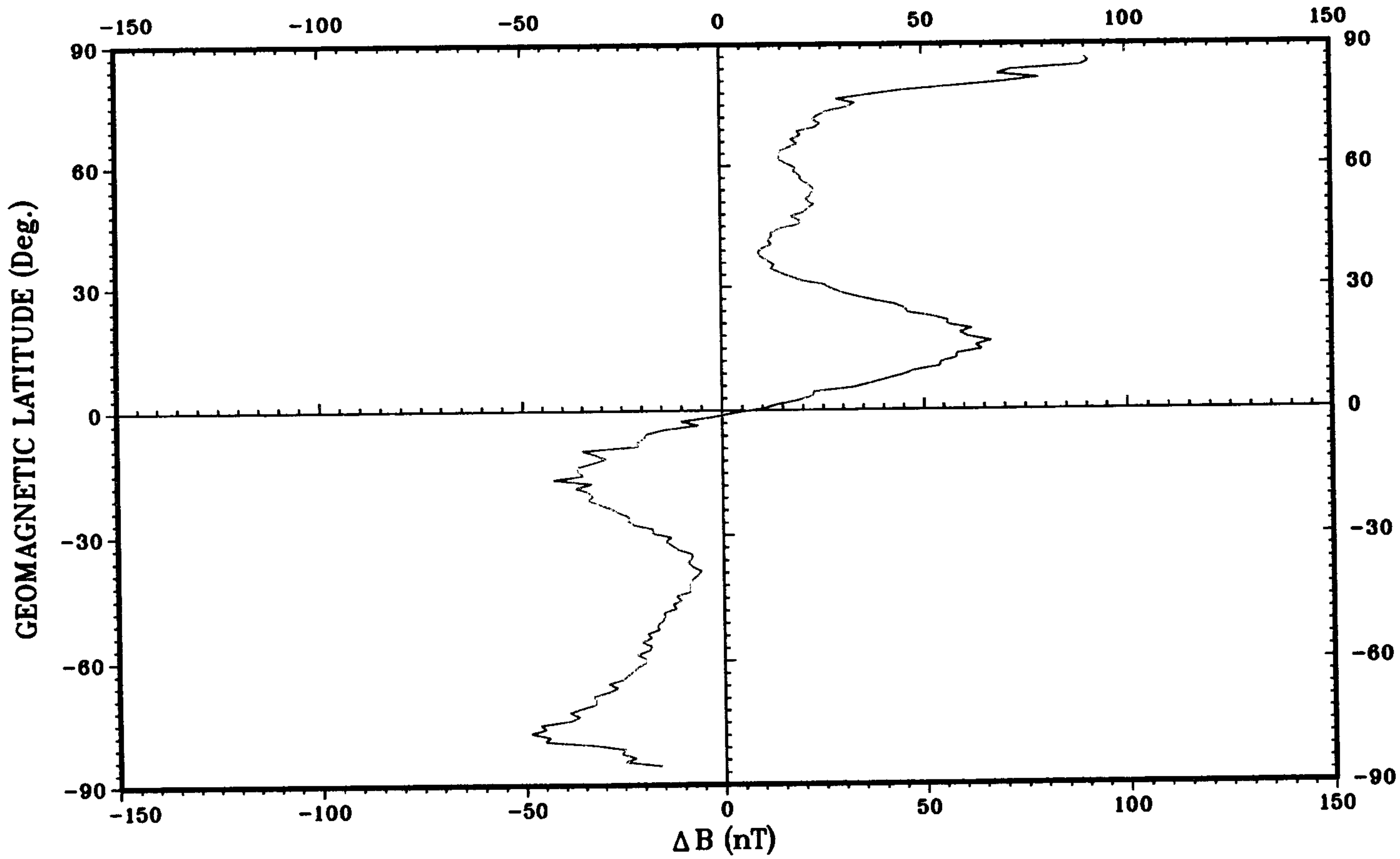


Figure 9. POGS Total Intensity Ionospheric-Field Correction: 1991, Days 131 - 140

IONOSPHERIC CORRECTION



File = pogs1211220.dst
Model = c-mdl_05.cof
Kp Max = 2.667

|Dst| ≤ 50.0 nT
Begin Local Time = 19.0 Hrs
End Local Time = 5.0 Hrs

Figure 10. POGS Total Intensity Ionospheric-Field Correction: 1991, Days 211 - 220

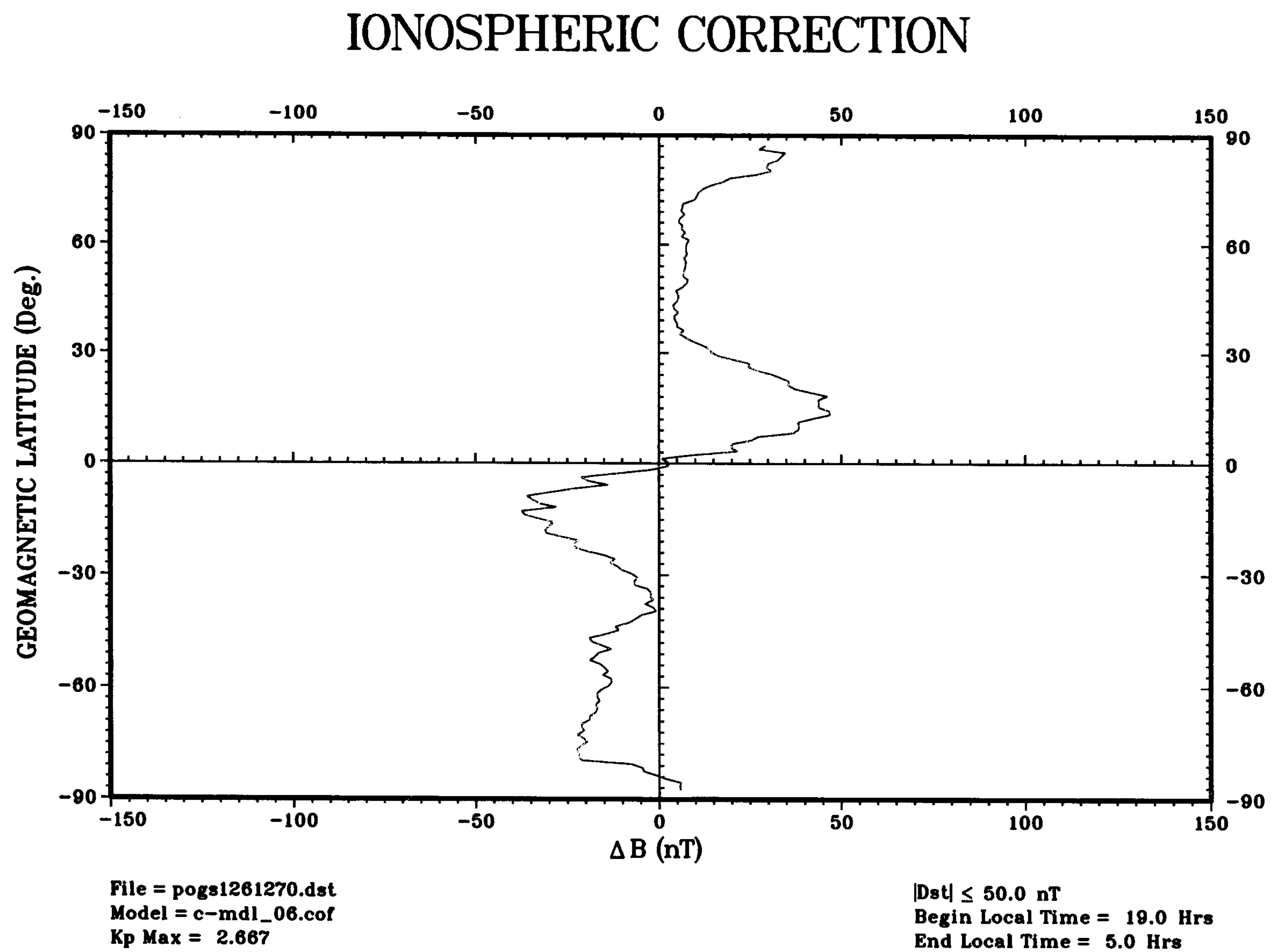


Figure 11. POGS Total Intensity Ionospheric-Field Correction: 1991, Days 261 - 270

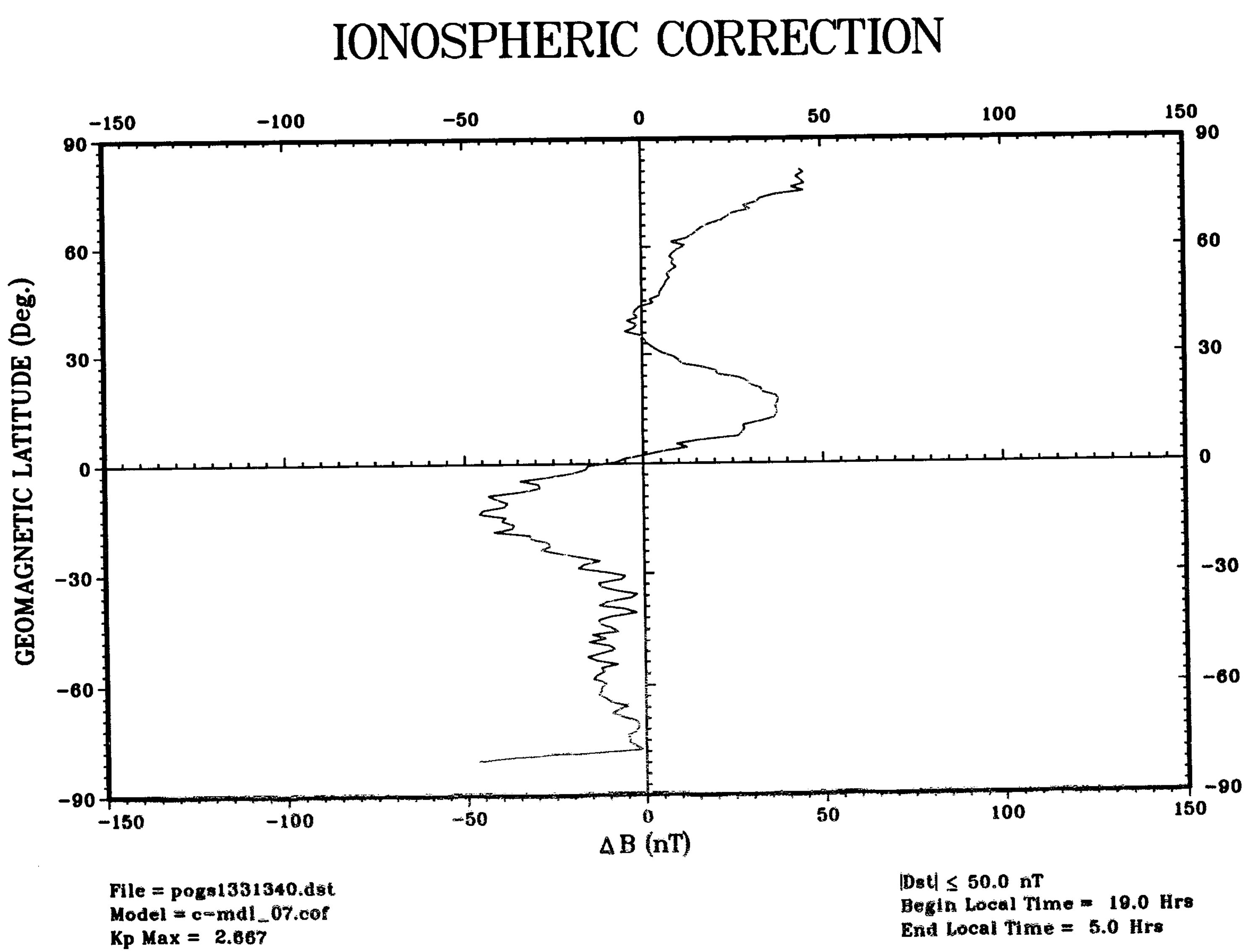


Figure 12. POGS Total Intensity Ionospheric-Field Correction: 1991, Days 331 - 340

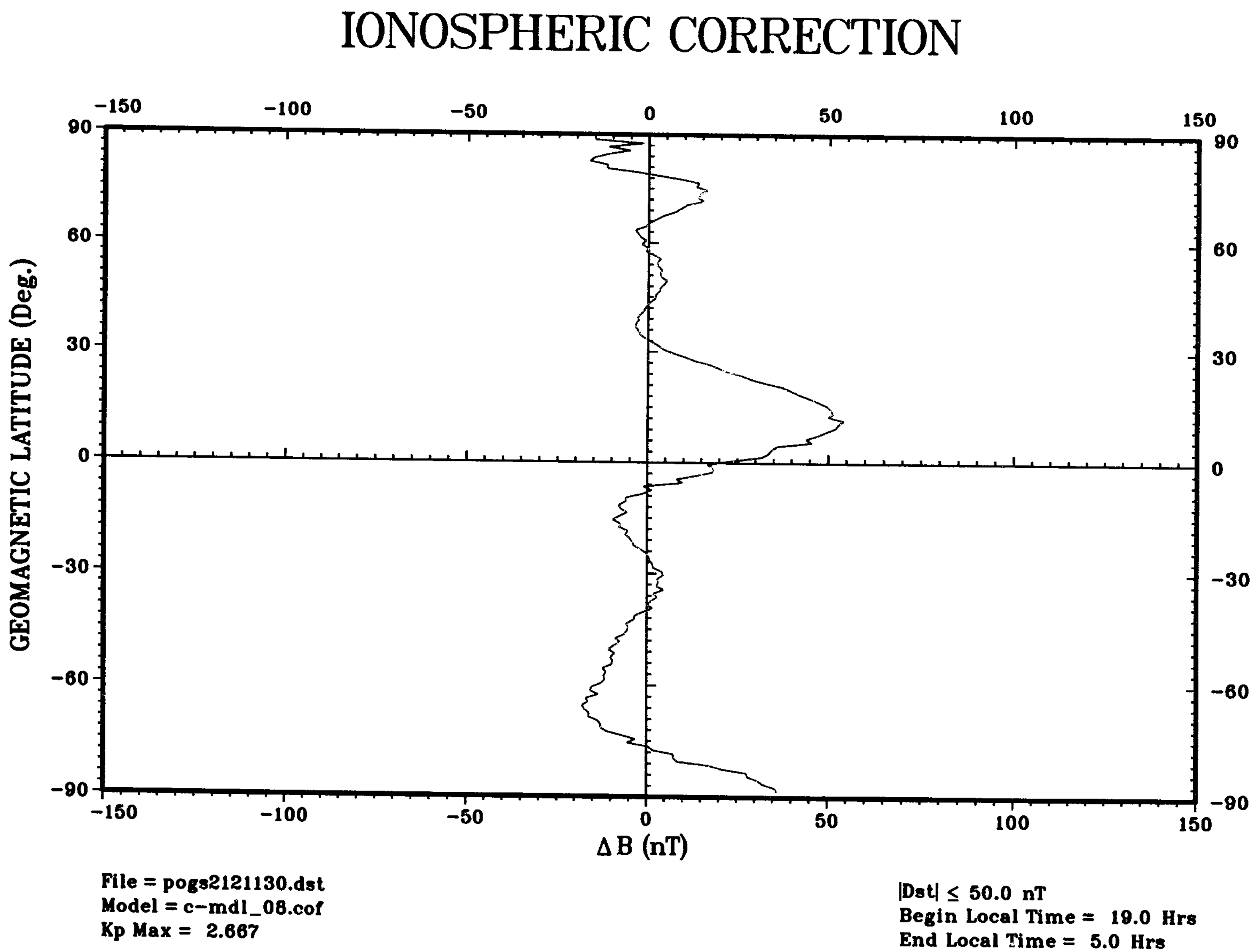


Figure 13. POGS Total Intensity Ionospheric-Field Correction: 1992, Days 121 - 130

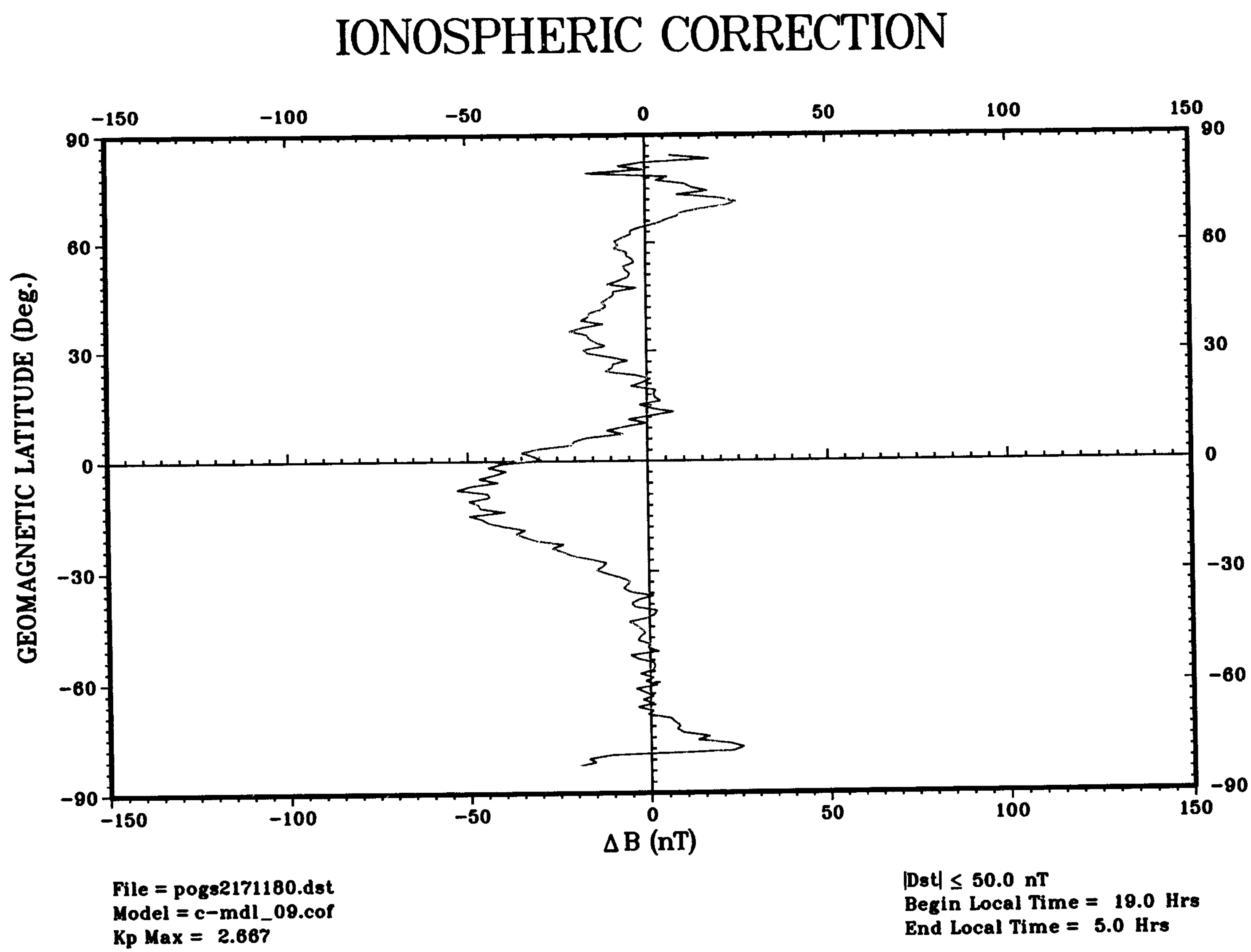


Figure 14. POGS Total Intensity Ionospheric-Field Correction: 1992, Days 171 - 180

IONOSPHERIC CORRECTION

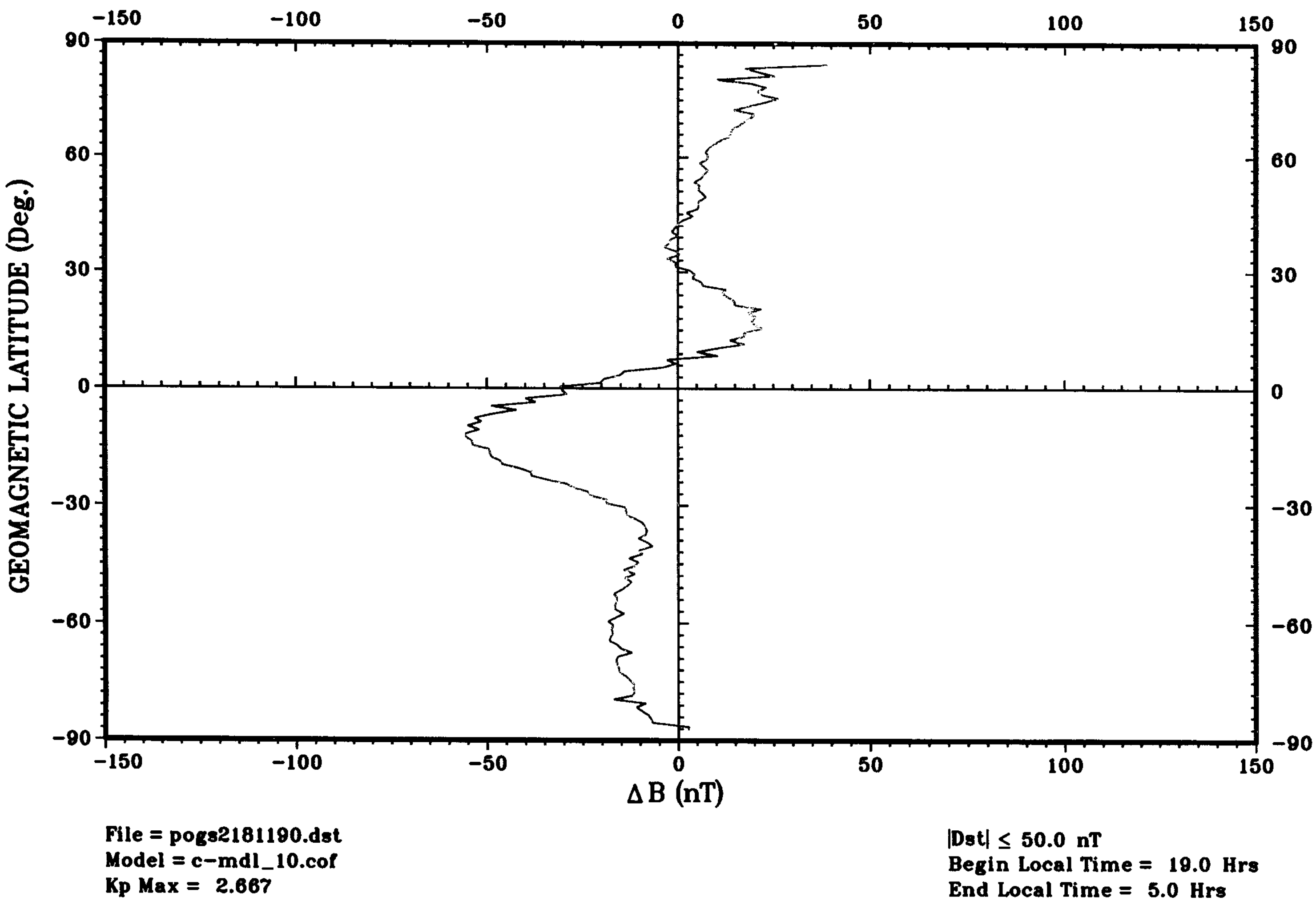


Figure 15. POGS Total Intensity Ionospheric-Field Correction: 1992, Days 181 - 190

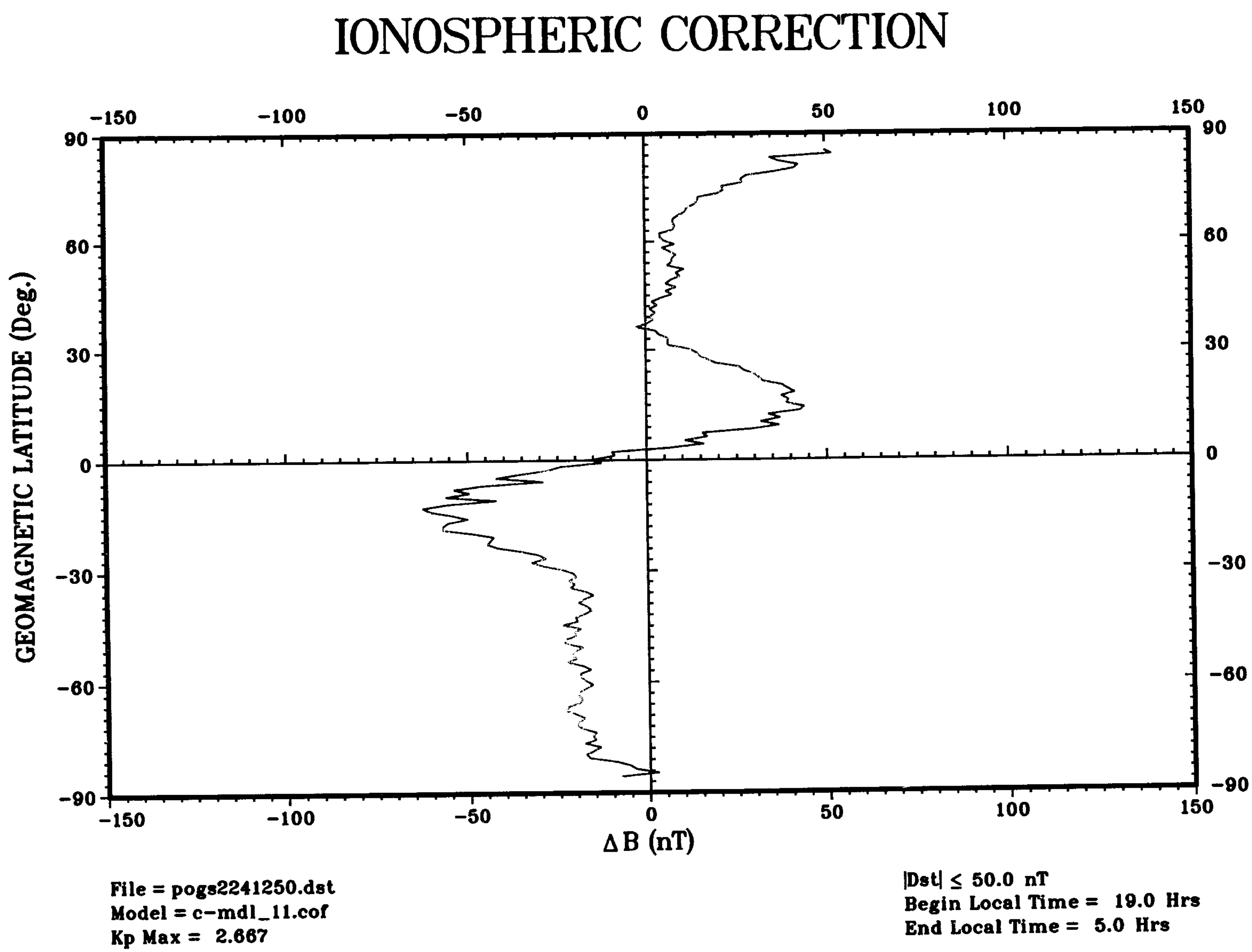
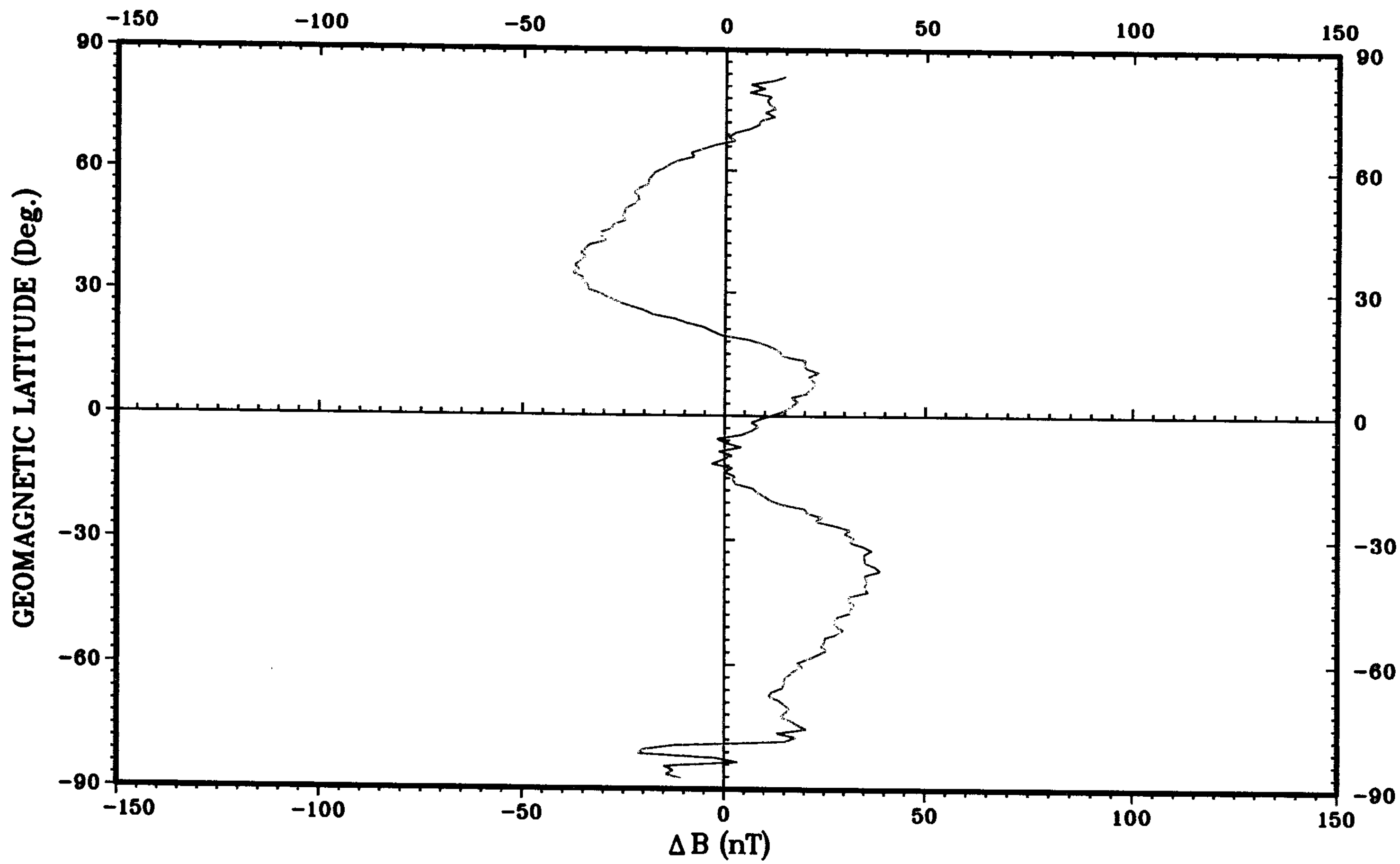


Figure 16. POGS Total Intensity Ionospheric-Field Correction: 1992, Days 241 - 250

IONOSPHERIC CORRECTION

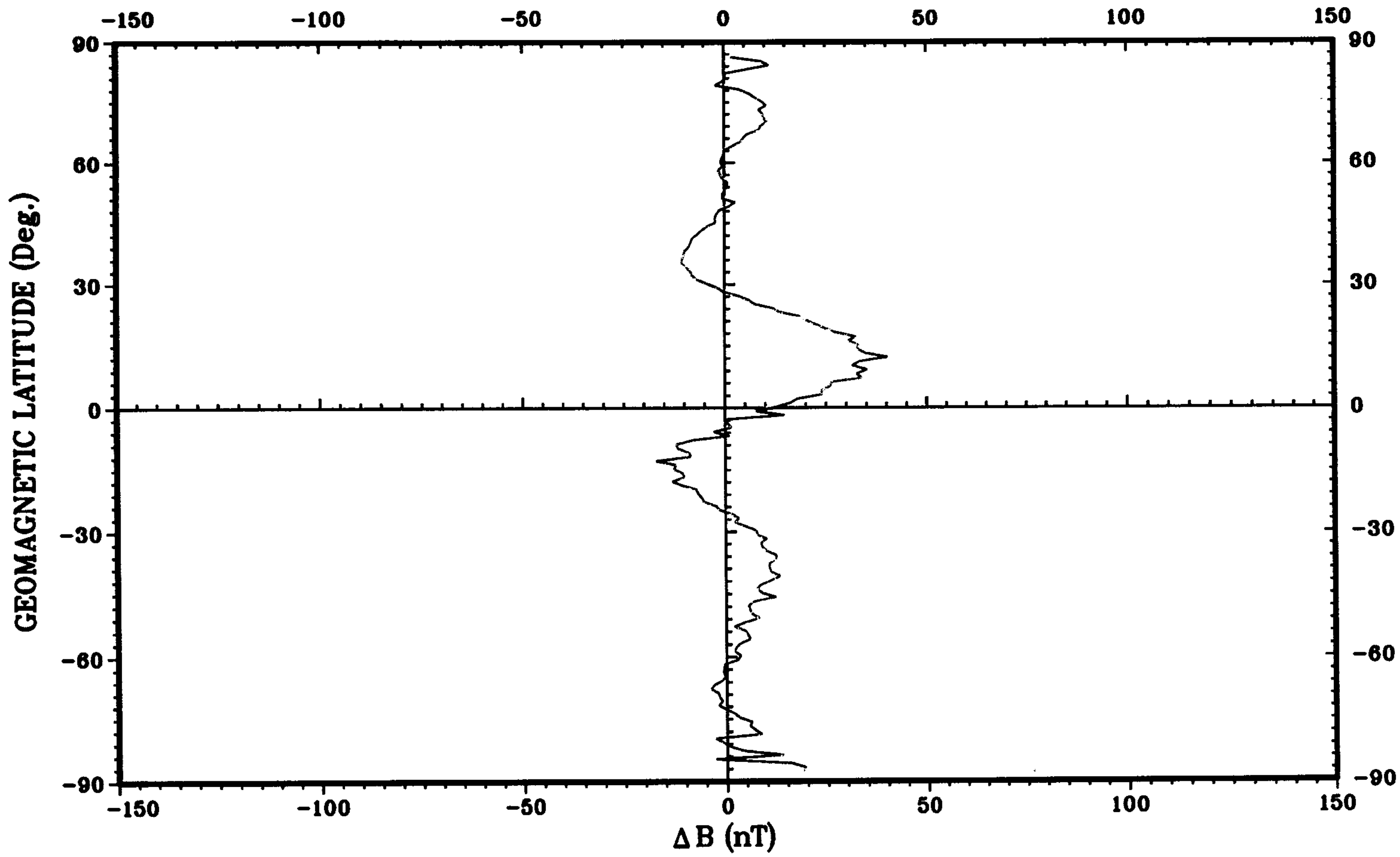


File = pogs3021030.dst
Model = c-mdl_12.cof
Kp Max = 2.667

|Dst| ≤ 50.0 nT
Begin Local Time = 19.0 Hrs
End Local Time = 5.0 Hrs

Figure 17. POGS Total Intensity Ionospheric-Field Correction: 1993, Days 021 - 030

IONOSPHERIC CORRECTION



File = pogs3141150.dst
Model = c-mdl_13.cof
Kp Max = 2.667

|Dst| ≤ 50.0 nT
Begin Local Time = 19.0 Hrs
End Local Time = 5.0 Hrs

Figure 18. POGS Total Intensity Ionospheric-Field Correction: 1993, Days 141 - 150

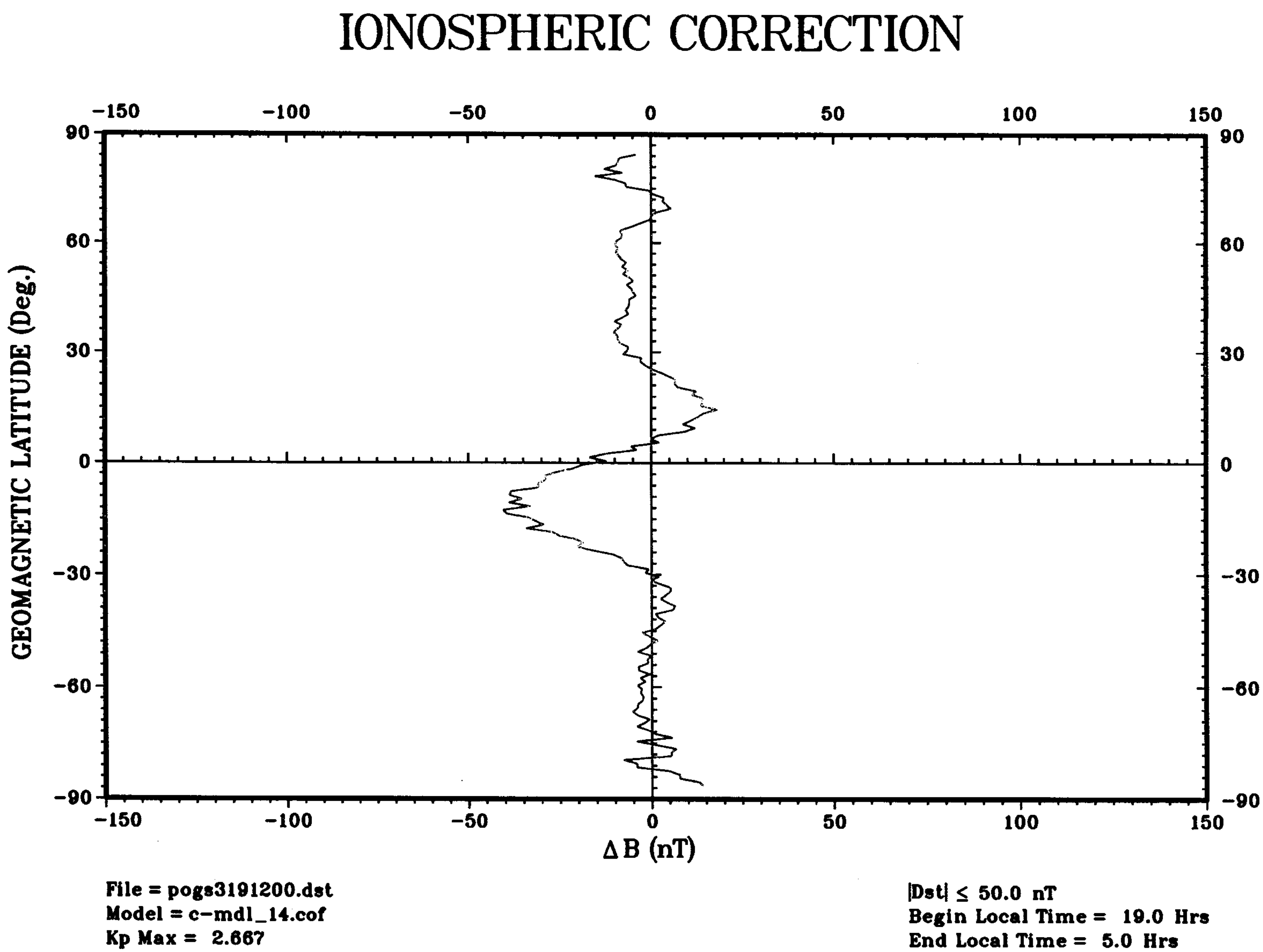
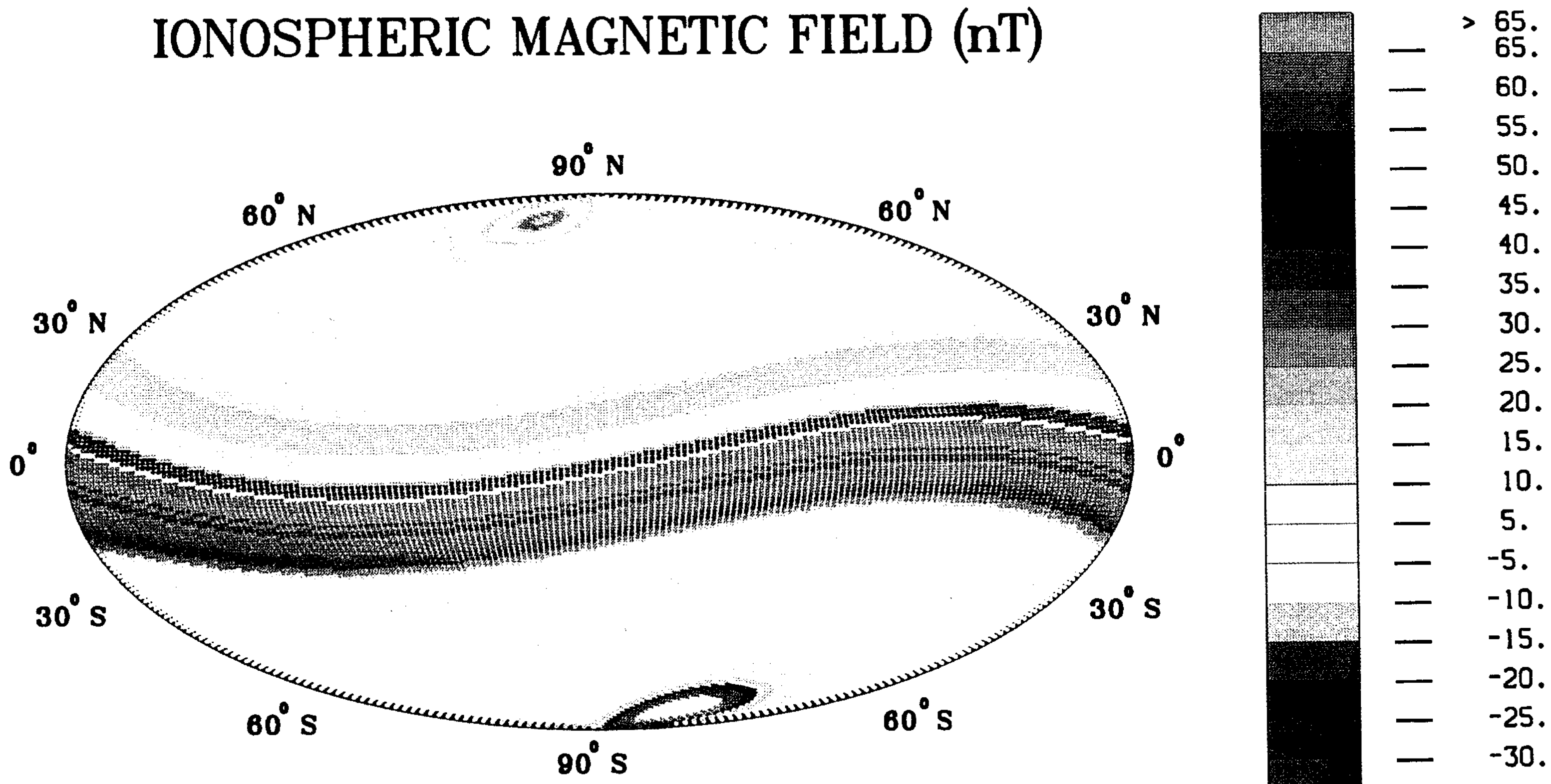


Figure 19. POGS Total Intensity Ionospheric-Field Correction: 1993, Days 191 - 200

IONOSPHERIC MAGNETIC FIELD (nT)



File = cion1011020.cor
Model = c–mdl_01.cof
Kp Max = 2.667
|Dst| ≤ 50.0 nT
Begin Local Time = 19.0 Hrs
End Local Time = 5.0 Hrs
Altitude = 750 km

Chart 47. Ionospheric Magnetic Field: 1991, Days 011 - 020

IONOSPHERIC MAGNETIC FIELD (nT)

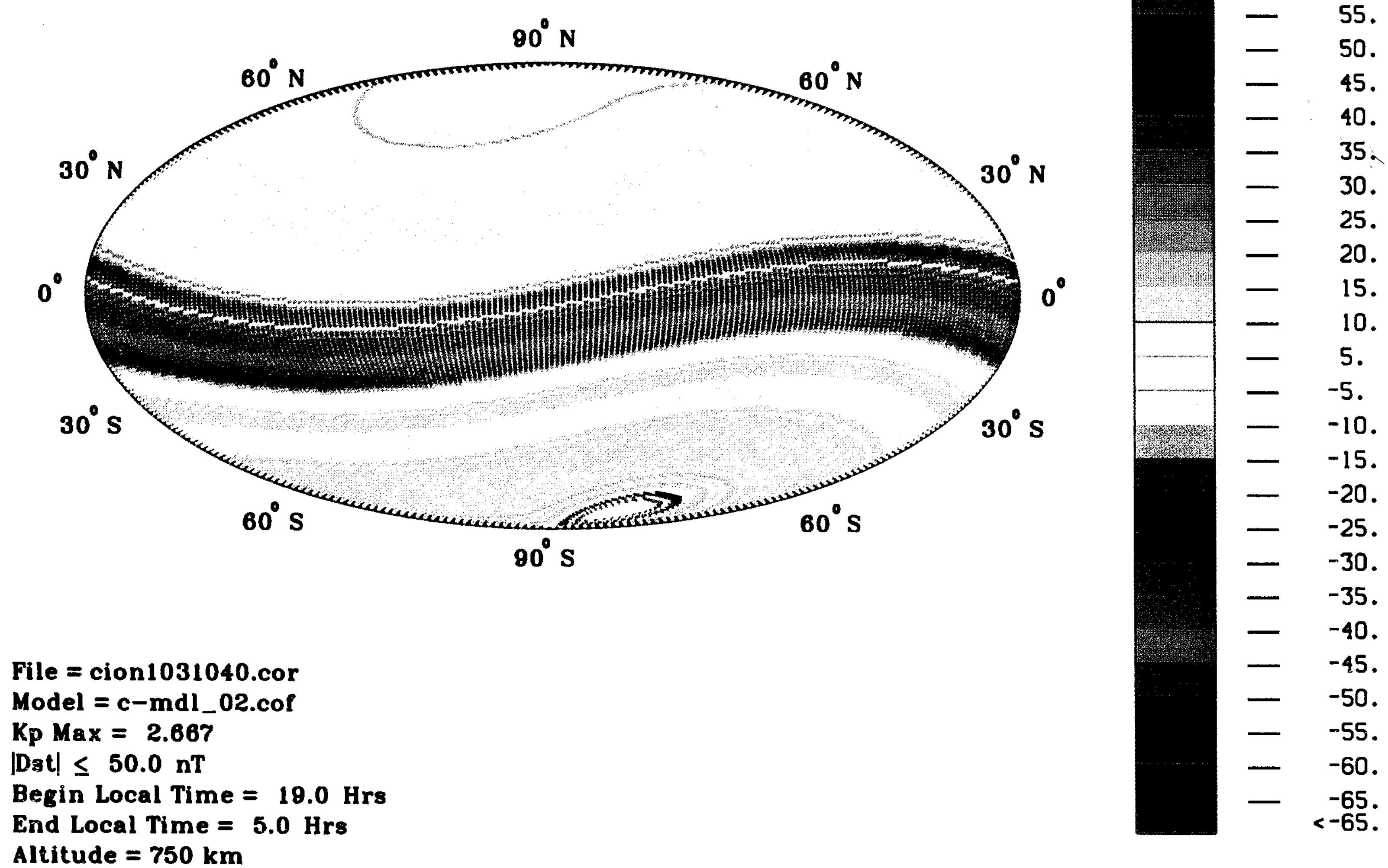


Chart 48. Ionospheric Magnetic Field: 1991, Days 031 - 040

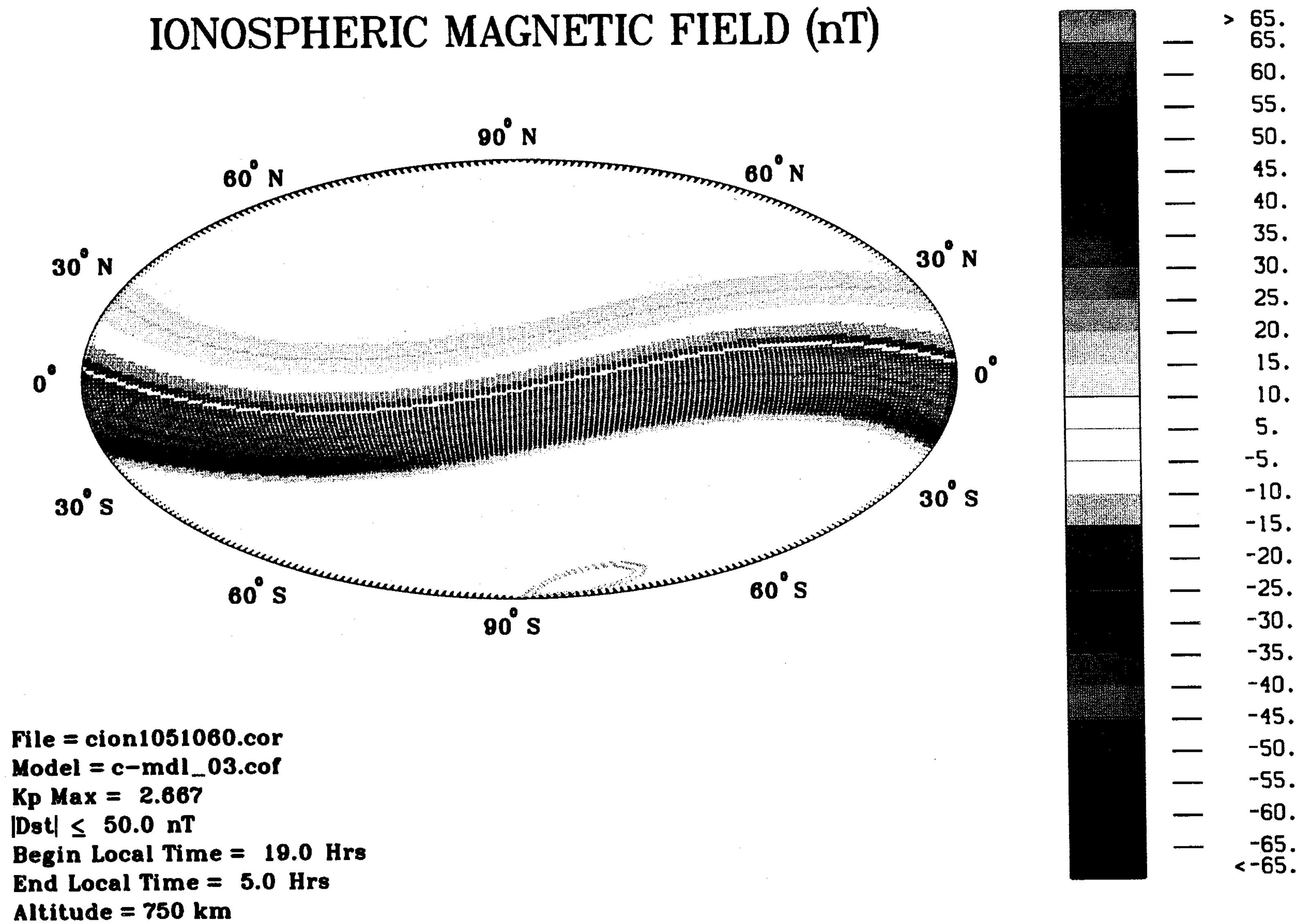
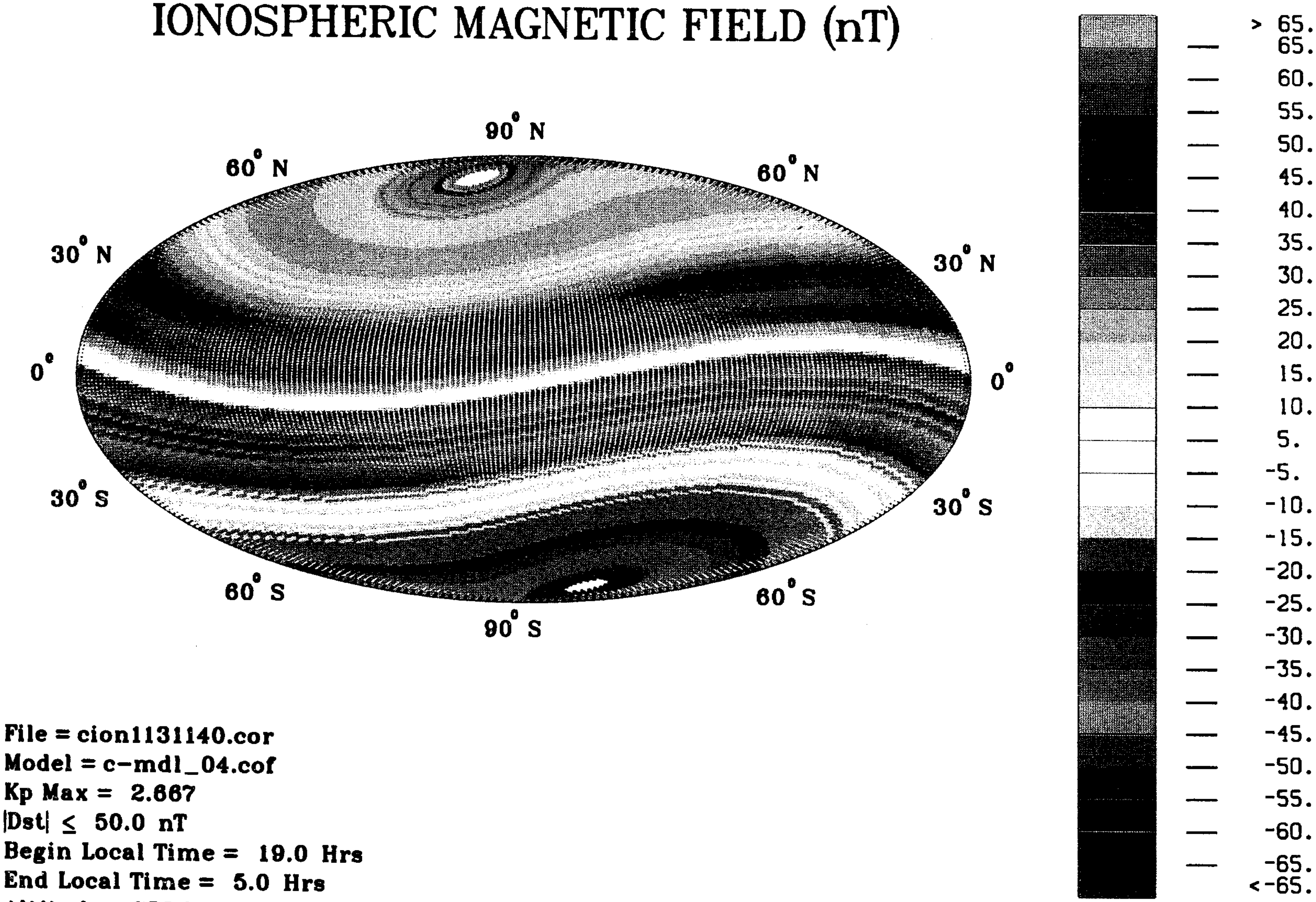


Chart 49. Ionospheric Magnetic Field: 1991, Days 051 - 060

IONOSPHERIC MAGNETIC FIELD (nT)



File = cion1131140.cor
Model = c−mdl_04.cof
Kp Max = 2.667
|Dst| ≤ 50.0 nT
Begin Local Time = 19.0 Hrs
End Local Time = 5.0 Hrs
Altitude = 750 km

Chart 50. Ionospheric Magnetic Field: 1991, Days 131 - 140

IONOSPHERIC MAGNETIC FIELD (nT)

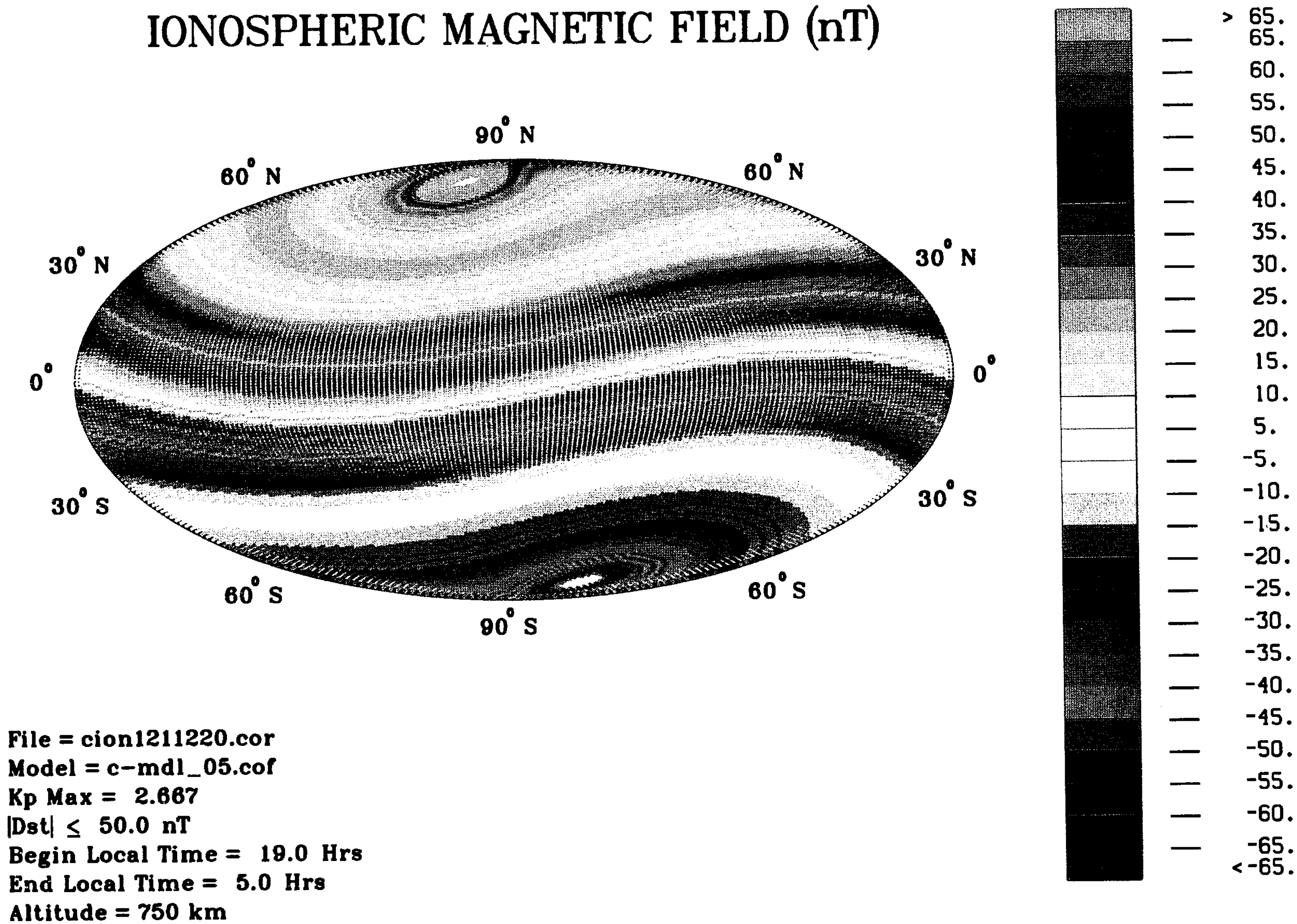


Chart 51. Ionospheric Magnetic Field: 1991, Days 211 - 220

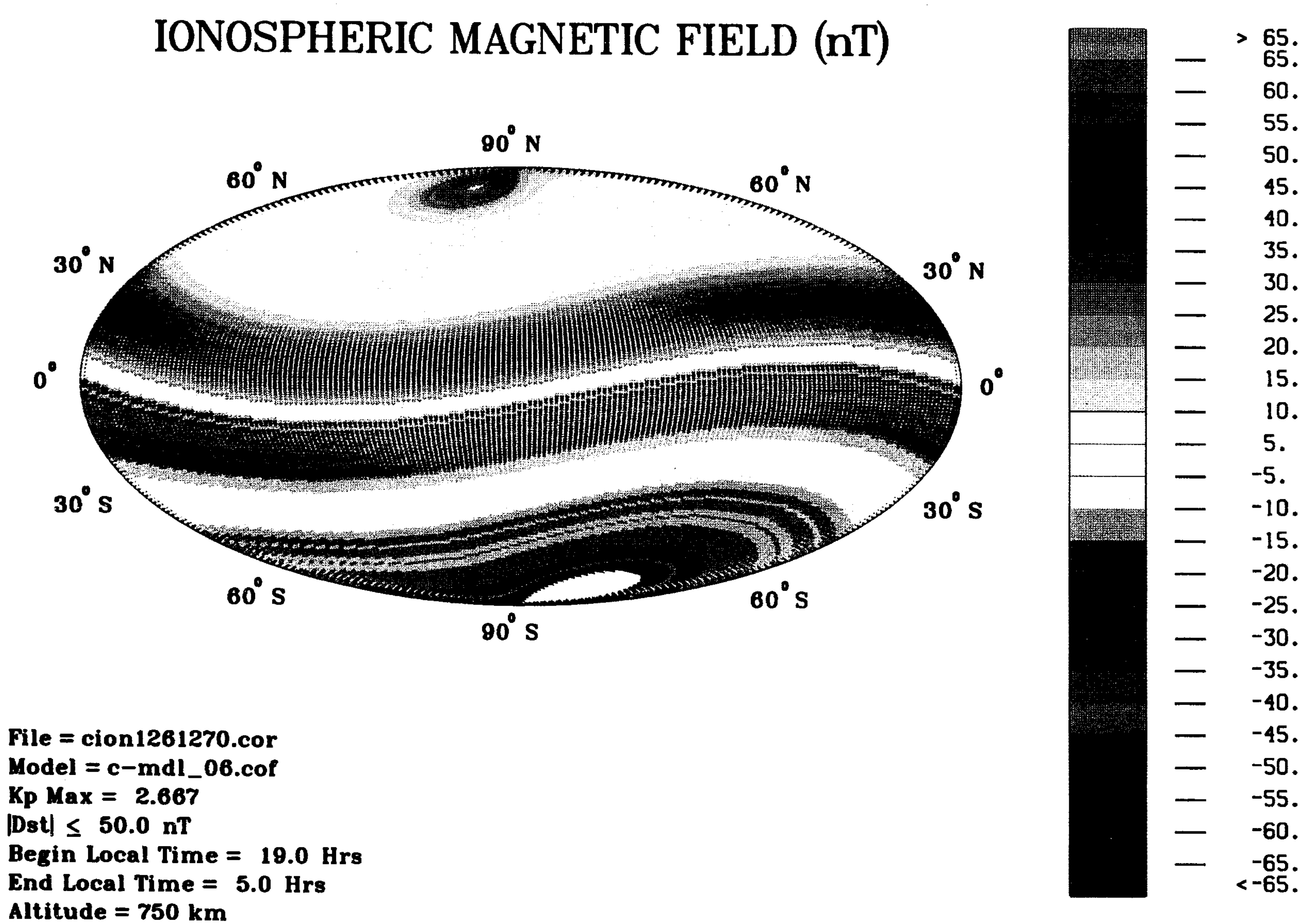


Chart 52. Ionospheric Magnetic Field: 1991, Days 261 - 270

IONOSPHERIC MAGNETIC FIELD (nT)

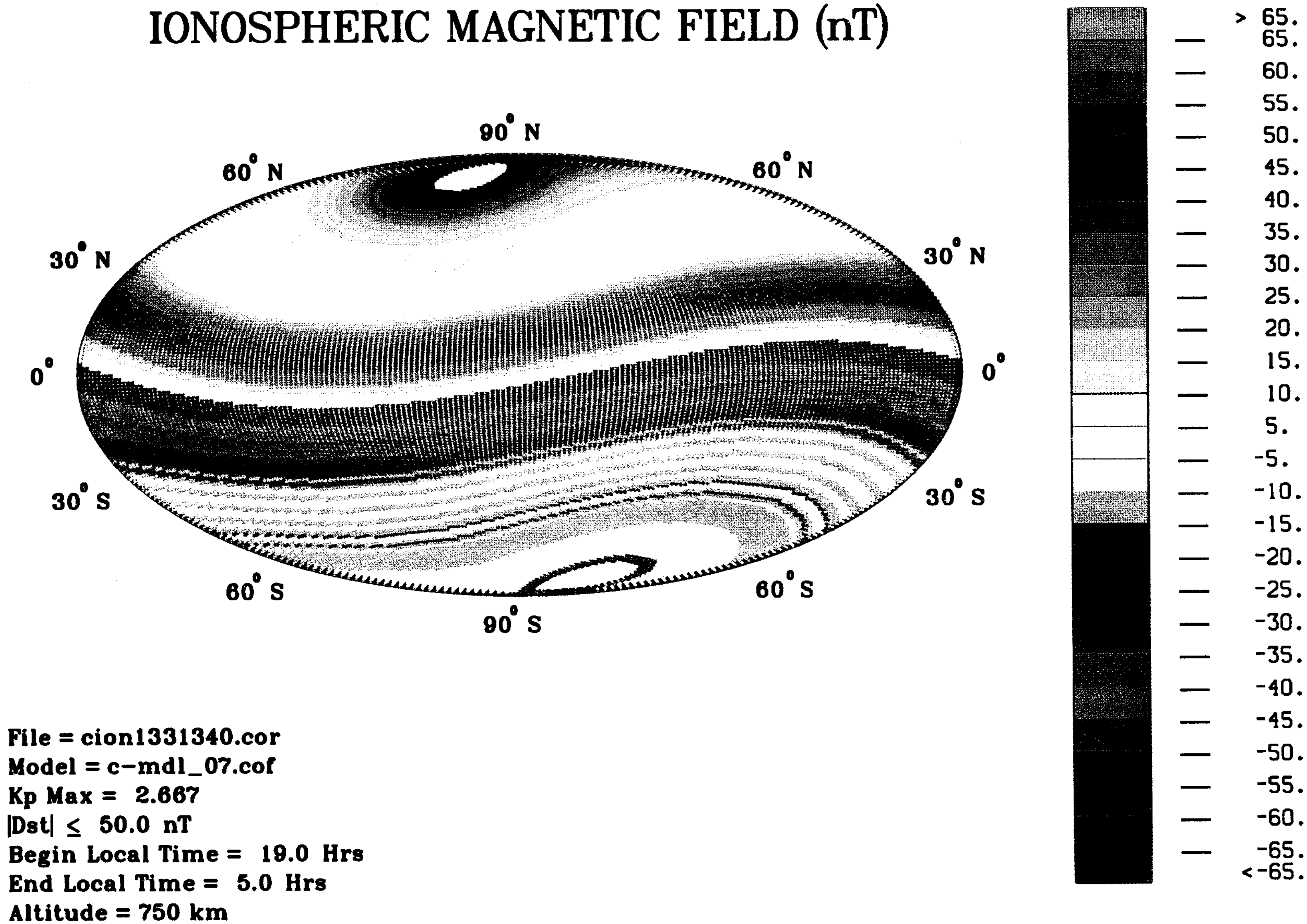


Chart 53. Ionospheric Magnetic Field: 1991, Days 331 - 340

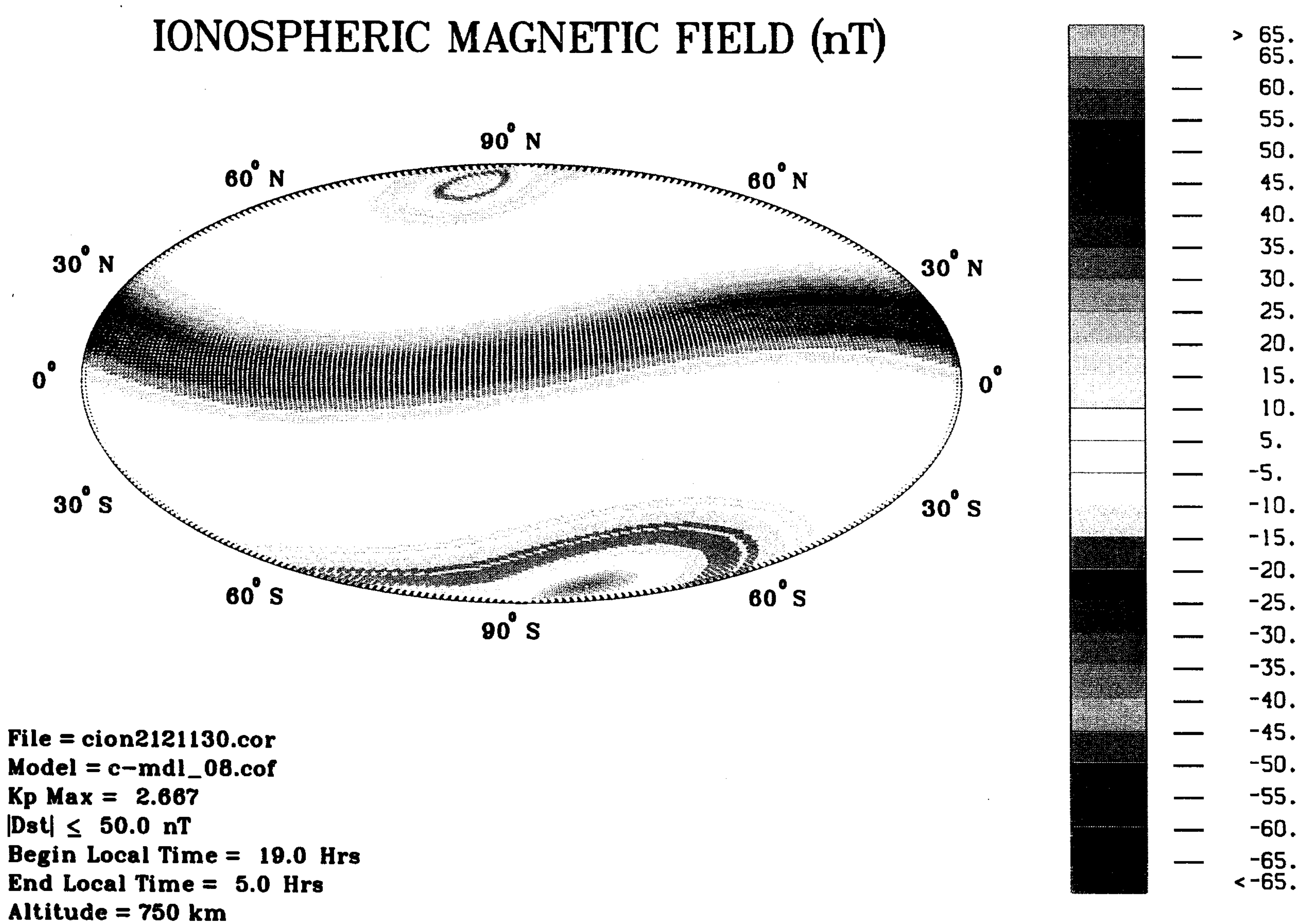
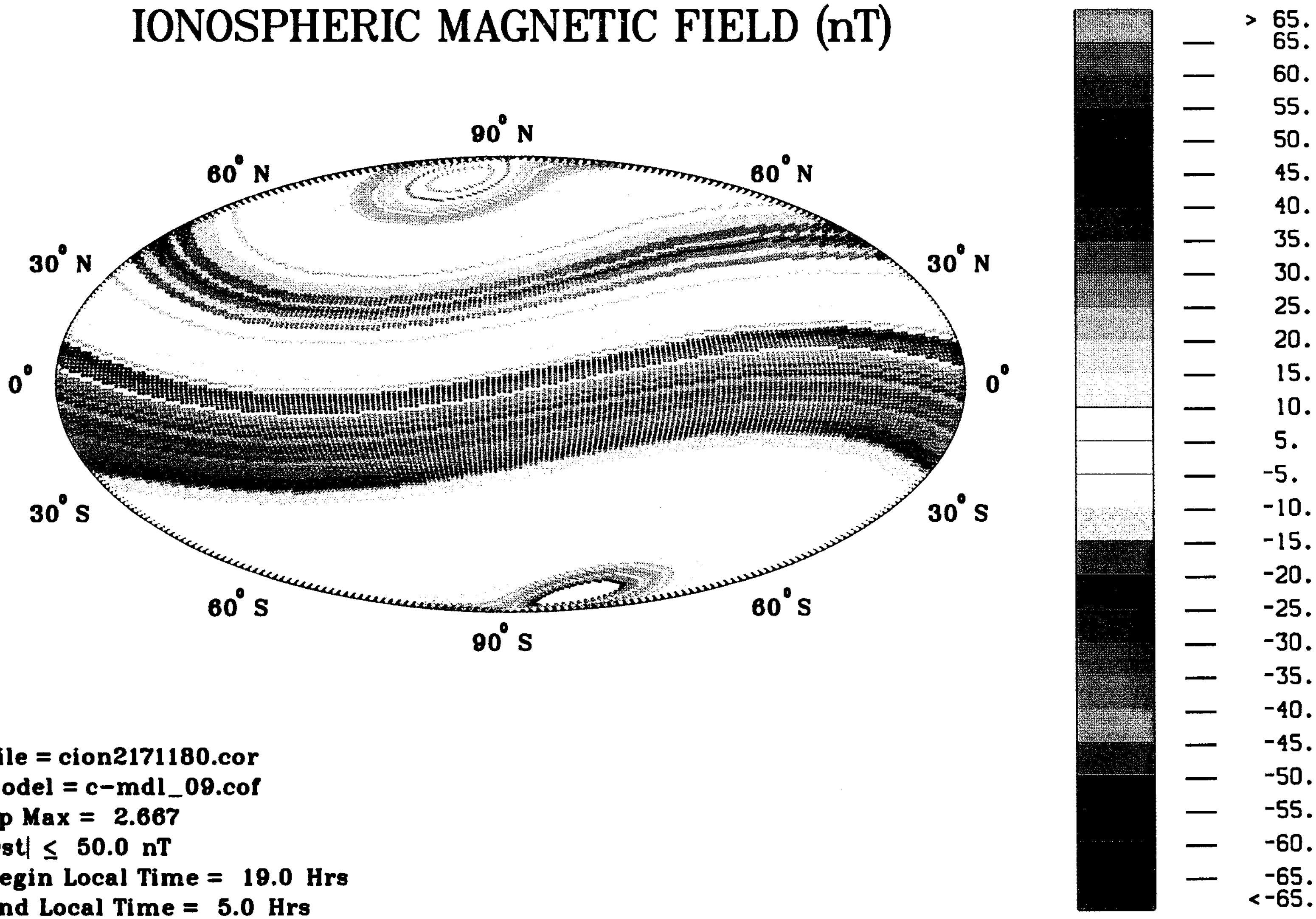


Chart 54. Ionospheric Magnetic Field: 1992, Days 121 - 130

IONOSPHERIC MAGNETIC FIELD (nT)



File = cion2171180.cor
Model = c-mdl_09.cof
Kp Max = 2.667
|Dst| ≤ 50.0 nT
Begin Local Time = 19.0 Hrs
End Local Time = 5.0 Hrs
Altitude = 750 km

Chart 55. Ionospheric Magnetic Field: 1992, Days 171 - 180

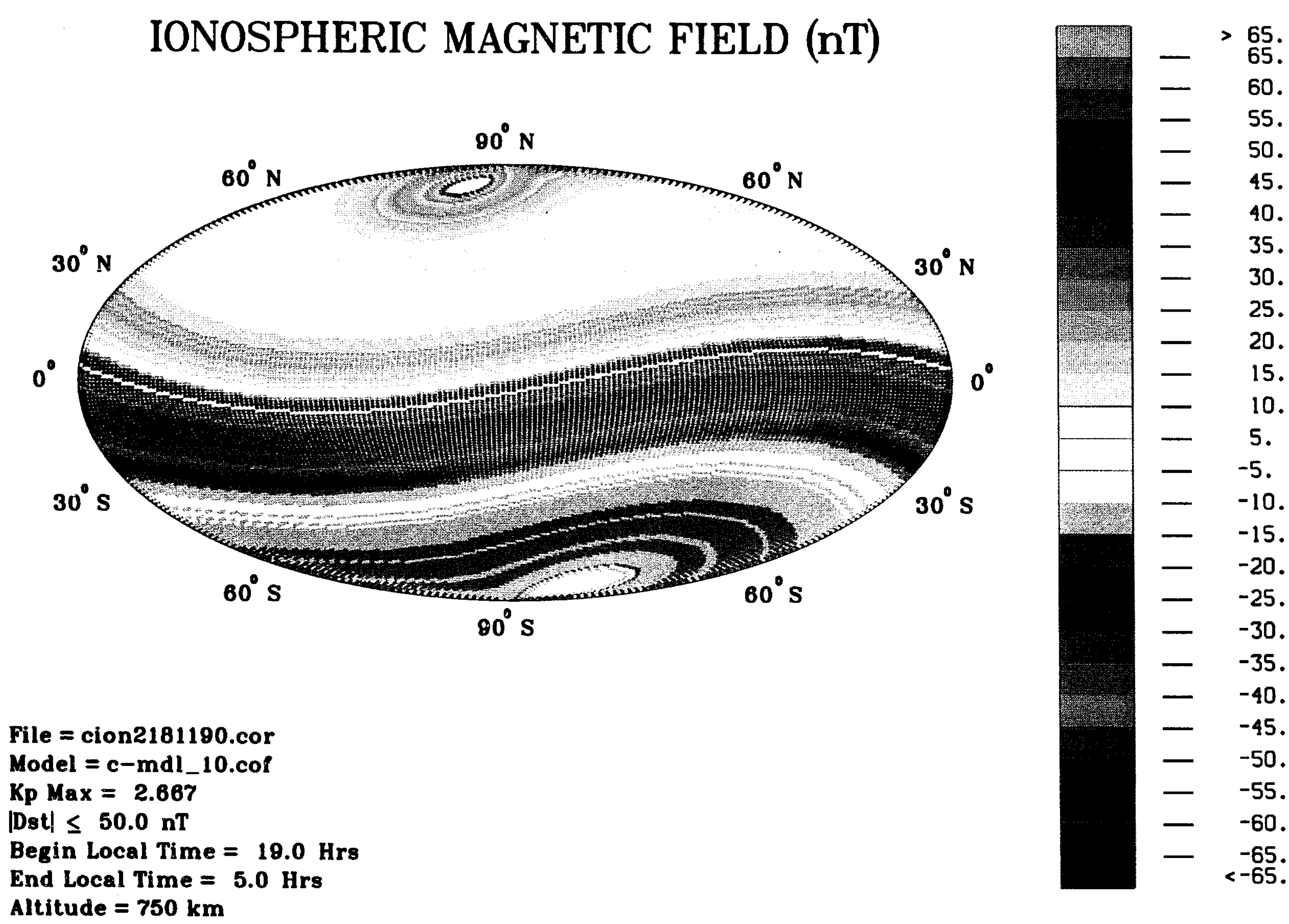
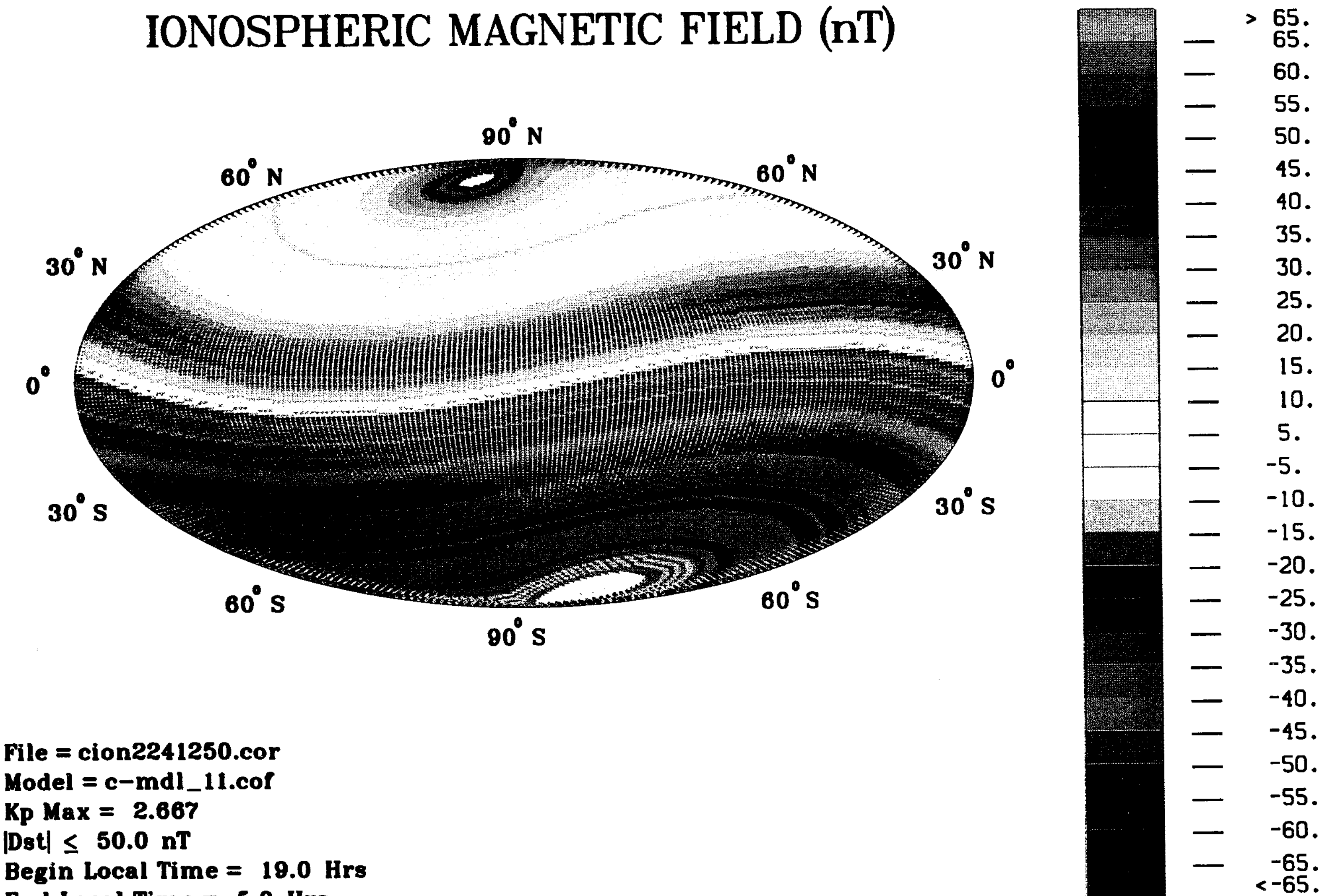


Chart 56. Ionospheric Magnetic Field: 1992, Days 181 - 190

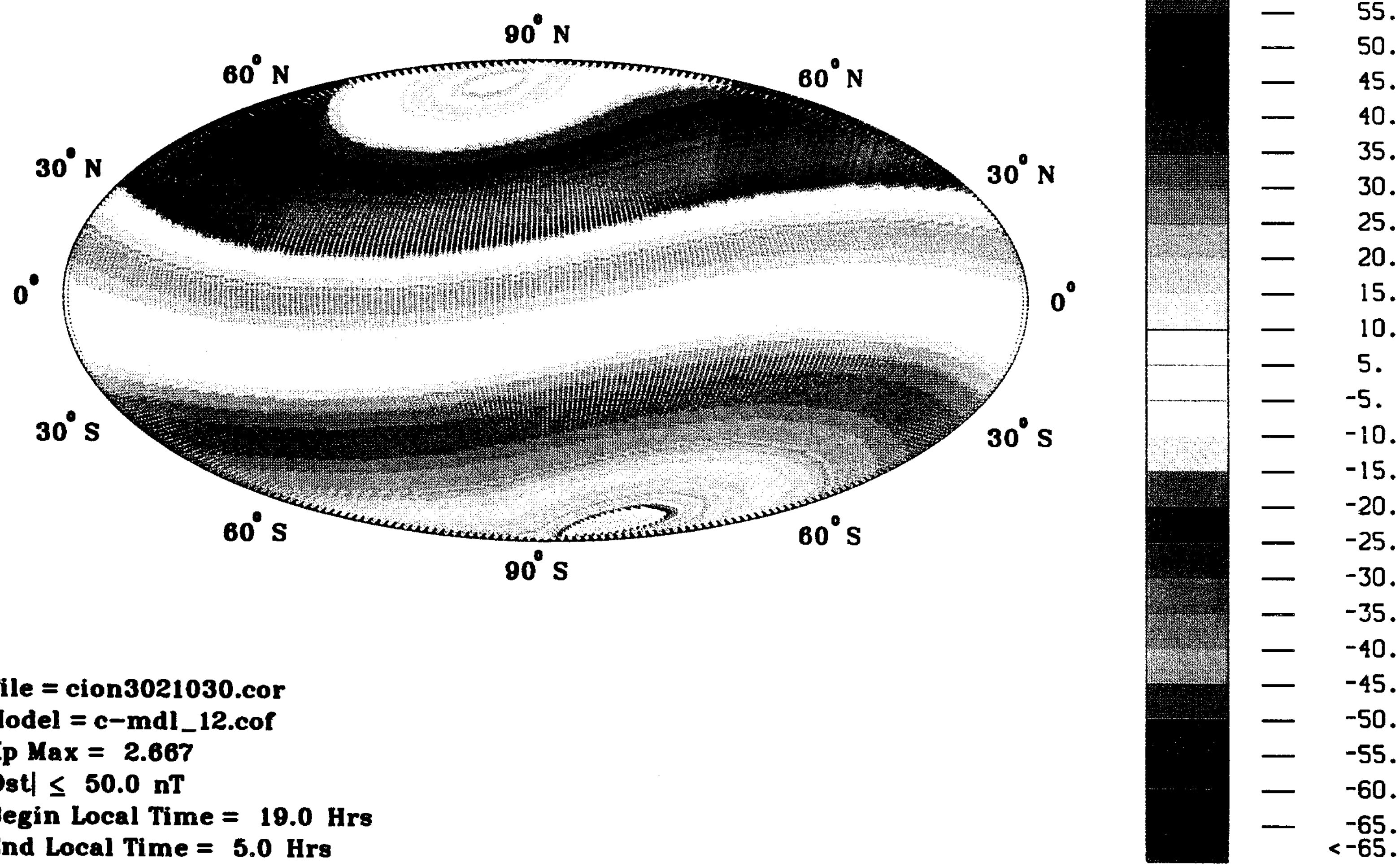
IONOSPHERIC MAGNETIC FIELD (nT)



File = cion2241250.cor
Model = c−mdl_11.cof
Kp Max = 2.667
|Dst| ≤ 50.0 nT
Begin Local Time = 19.0 Hrs
End Local Time = 5.0 Hrs
Altitude = 750 km

Chart 57. Ionospheric Magnetic Field: 1992, Days 241 - 250

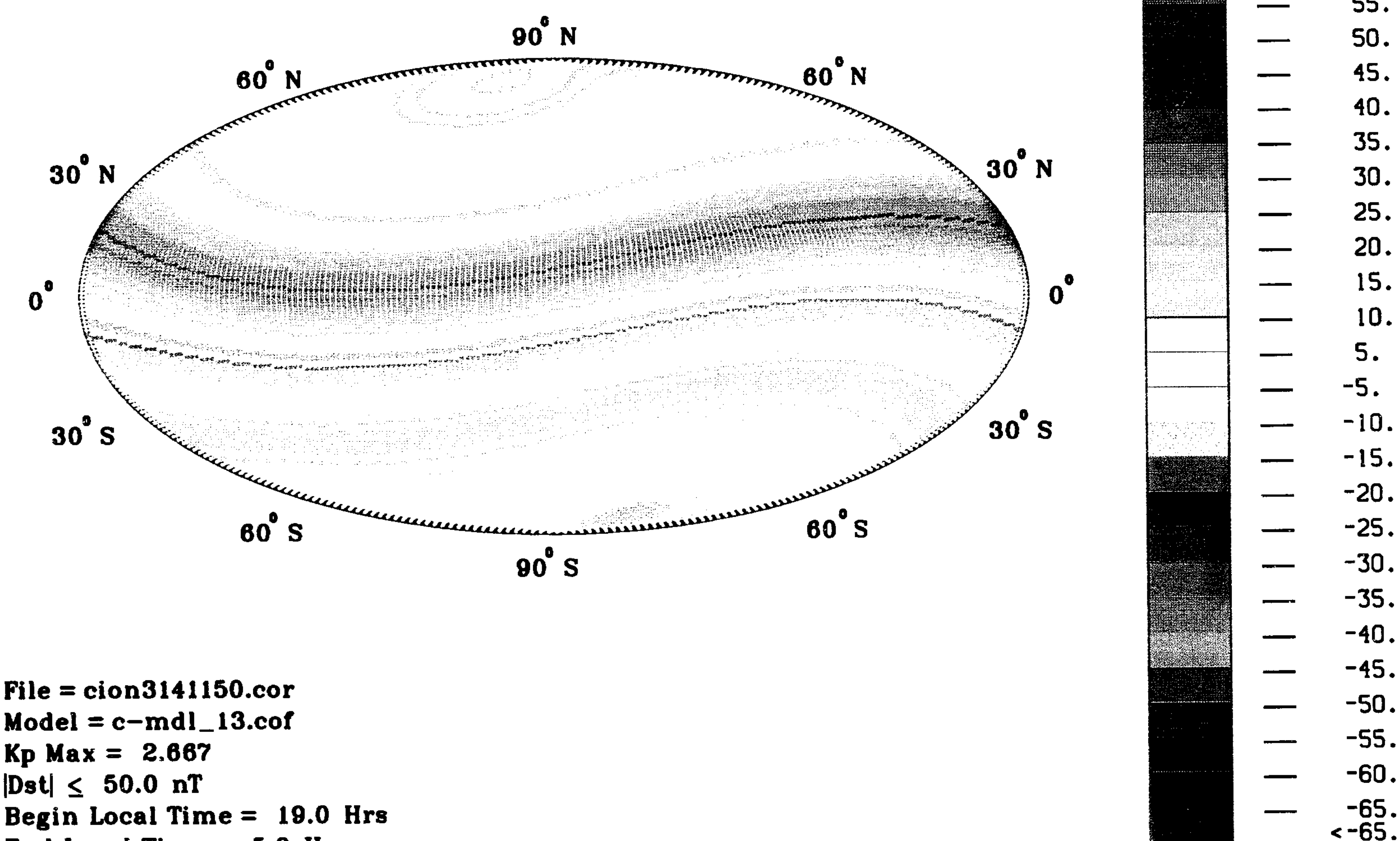
IONOSPHERIC MAGNETIC FIELD (nT)



File = cion3021030.cor
Model = c−mdl_12.cof
Kp Max = 2.667
|Dst| ≤ 50.0 nT
Begin Local Time = 19.0 Hrs
End Local Time = 5.0 Hrs
Altitude = 750 km

Chart 58. Ionospheric Magnetic Field: 1993, Days 021 - 030

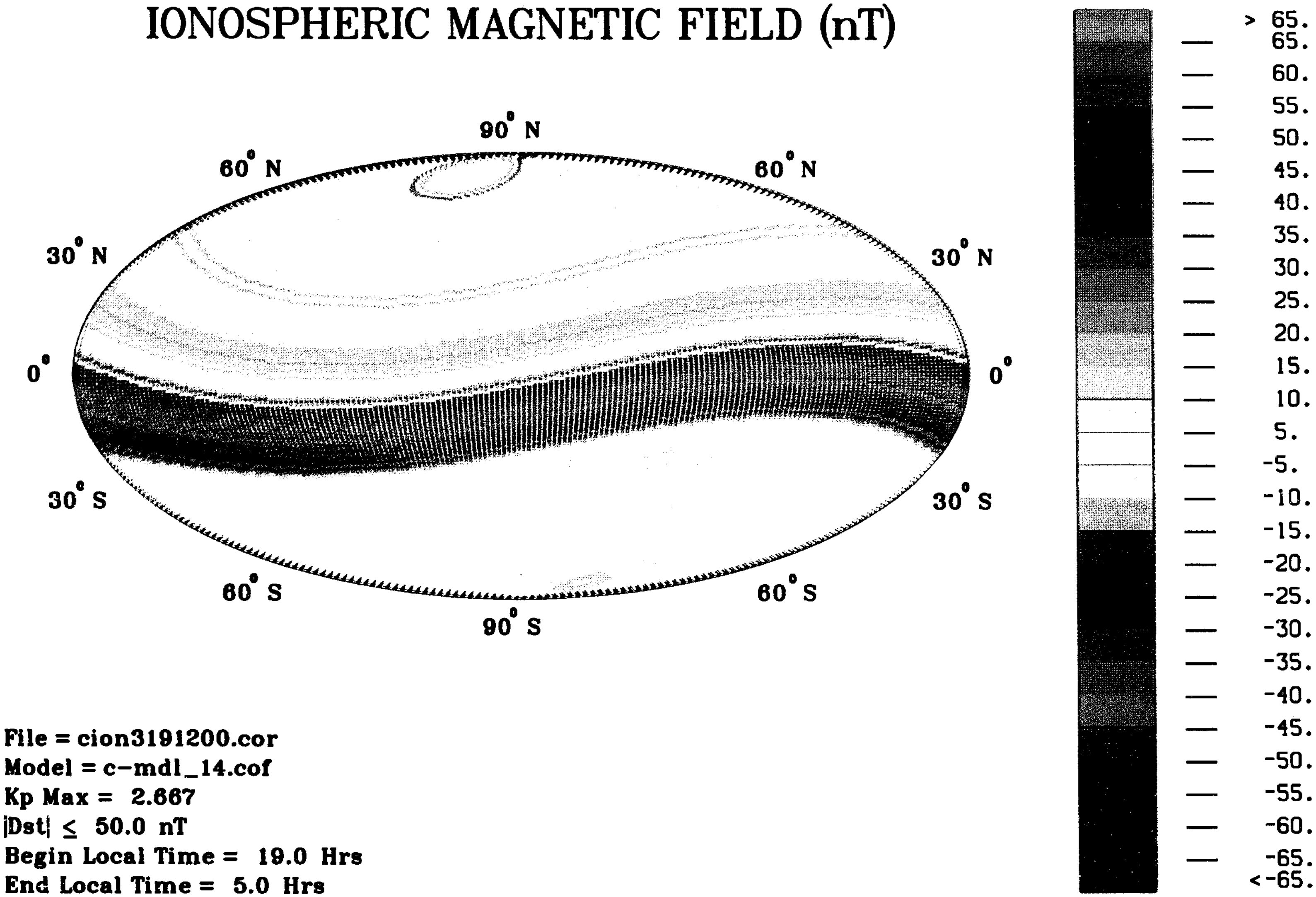
IONOSPHERIC MAGNETIC FIELD (nT)



File = cion3141150.cor
Model = c–mdl_13.cof
Kp Max = 2.667
|Dst| ≤ 50.0 nT
Begin Local Time = 19.0 Hrs
End Local Time = 5.0 Hrs
Altitude = 750 km

Chart 59. Ionospheric Magnetic Field: 1993, Days 141 - 150

IONOSPHERIC MAGNETIC FIELD (nT)



File = cion3191200.cor
Model = c-mdl_14.cof
Kp Max = 2.667
|Dst| ≤ 50.0 nT
Begin Local Time = 19.0 Hrs
End Local Time = 5.0 Hrs
Altitude = 750 km

Chart 60. Ionospheric Magnetic Field: 1993, Days 191 - 200

effects, as monitored by the Dst index, not already removed via the subtraction of the external fields discussed in the previous subsection, where:

$$\chi_r^2 = \sum_{i=1}^{I_r} w_{ri}(B_{ri} - b_{ri})^2 \tag{36a}$$

$$\chi_\theta^2 = \sum_{i=1}^{I_\theta} w_{\theta i}(B_{\theta i} - b_{\theta i})^2 \tag{36b}$$

$$\chi_\varphi^2 = \sum_{i=1}^{I_\varphi} w_{\varphi i}(B_{\varphi i} - b_{\varphi i})^2 \tag{36c}$$

$$\chi_F^2 = \sum_{i=1}^{I_F} w_{Fi}(B_{Fi} - b_{Fi})^2 \tag{36d}$$

Uppercase B's refer to the model values of their respective magnetic components, while the lower case b's refer to the observed (measured) values of their respective magnetic components. The subscript i refers to a particular data point. The total number I of data points may be different for each magnetic component. Each data point has a weight w which depends on several factors:

a. Data Type: w_T

w_T(POGS) = 1 $\qquad$ m = 1

w_T(Project MAGNET) = 1 $\qquad$ m = 2

Project MAGNET observatory airswing calibrations yield RMS errors on the order of 35 nT, while POGS RMS residual errors for each 10-day file with respect to the WMM-90 (modified) model average approximately 45 nT. These two numbers are indicators of the relative quality of the two data sets. The ratio of these two numbers is approximately equal to one. Consequently, the two data sets are assigned unit weight relative to each other.

b. Equal Area Weighting: w_A

On a sphere satellite and aircraft magnetic data tend to be more concentrated at the geographic poles than at the equator. Since there is no reason to give one area of the world more weight than any other, a colatitude (θ) dependent weight factor is applied to each data point such that:

$$w_A(\theta) = \sin\theta \tag{37}$$

c. Geomagnetic Latitude Weighting: w_M

If only scalar Total Intensity data are used for modeling purposes, then the resulting model will generate large spurious magnetic anomalies along the geomagnetic equator which can extend to mid-latitudes. On the other hand, it is desirable to use as much scalar Total Intensity data and as little vector-magnetic data as possible in the modeling process because the vector data has additional attitude determination errors associated with it which tend to make vector data generally less accurate than the scalar Total Intensity data computed from it (Lowes and Martin [1987]). Consequently, in order to maximize the accuracy of the resulting model, Project MAGNET vector-aeromagnetic data were used in a band straddling $\pm 20^0$ about the geomagnetic equator to counter the Backus effect, while outside of this band, both POGS and Project MAGNET scalar Total Intensity data were used. However, by design, Project MAGNET surveys were concentrated in the equatorial band where vector data was critically needed. Therefore, very little Project MAGNET data were collected outside of this band, the exception being occasional excursions to the geomagnetic poles. Taking Θ_M as the *geomagnetic* latitude, this weight factor takes the following form:

$$|\Theta_M| \le 20^0 \quad \left\{ \begin{array}{lll} w_M(\Theta_M) = 1 & & for\ k = 1,2,3(r,\theta,\varphi) \\ w_M(\Theta_M) = 0 & & for\ k = 4(F) \end{array} \right\} \ ; \ n \equiv 1 \tag{38a}$$

$$|\Theta_M| > 20^0 \quad \left\{ \begin{array}{lll} w_M(\Theta_M) = 0 & & for\ k = 1,2,3(r,\theta,\varphi) \\ w_M(\Theta_M) = 1 & & for\ k = 4(F) \end{array} \right\} \ ; \ n \equiv 2 \tag{38b}$$

d. Relative Weighting Among Project MAGNET Flights and POGS 10-day Files: w_R

RMS statistics were computed for the *r, θ, φ,* and *F* magnetic components of Project MAGNET data on a flight by flight basis. Statistics were also computed for the *F* magnetic component of the POGS data on a 10-day file by 10-day file basis. These statistics were computed relative to the WMM-90 (modified) model. Relative weights were assigned for each magnetic component using the squared ratio of the *average* RMS error for a given magnetic component for all flights (10-day files) used in a model to that of a particular flight (10-day file) for the same magnetic component. If k is taken as the index for a particular flight (10-day file) and if l is taken as the index representing a particular magnetic component (r,θ,φ, F), then :

$$w_R = \left(\frac{\bar{\sigma}_l}{\sigma_{kl}} \right)^2 \tag{39}$$

e. Outlier Weighting: w_O

Editing the quiet-time POGS data was not a straightforward matter due to the fact that the Spread-F effect was broadly present at essentially all latitudes and tended to blend in with the Field-Aligned current effects in the auroral regions. Consequently, there were no localized features indicative of solar-induced ionospheric/magnetospheric activity that could be easily removed from the data through interactive computer graphic editing or through statistical winnowing without a substantial loss of data. Consequently, the average Spread-F and Field-Aligned current effects were removed via preliminary modeling of the POGS data as previously indicated. However, some of the external field activity could deviate substantially from the 10-day average. Therefore, these outliers, which would primarily occur in the auroral zones, were down-weighted via the following weight factor:

$$w_O = e^{-\left(\frac{\Delta B}{3\sigma}\right)^2} \tag{40}$$

where ΔB is the Total Intensity residual of the data point, and σ is the RMS error of its corresponding 10-day file with respect to the WMM-90 (modified) model.

Project MAGNET vector and scalar data, having been collected much nearer to the Earth's surface, were subject to magnetic contamination from crustal sources as well as from Ionospheric sources such as the Sq currents and the EE currents, both of which are located between 100-km and 200-km altitude. Outliers in Project MAGNET survey data due to these sources were down-weighted in the same manner as POGS, data using eq. (40), with ΔB representing the vector or scalar residuals with respect to the WMM-90 (modified) model and σ representing the RMS statistics for a particular survey flight and magnetic component. This weighting is in lieu of applying along-track, low-pass filters with 750-km wavelength cutoffs to the aeromagnetic data. Such filtering also results in a substantial loss of data.

Since the Project MAGNET data and the POGS data were essentially collected concurrently in time, there was no age-dependent weight factor applied to the data in contrast to the 1990 Epoch modeling procedures. The total weight applied to a specified data point is the product of the foregoing weight factors, so that:

$$w_{iklmn} = w_{Tm} w_{Mn}(\Theta_{Mi}) \left(\frac{\bar{\sigma}_{lm}}{\sigma_{klm}}\right)^2 e^{-\left(\frac{\Delta B_i}{3\sigma_{klm}}\right)^2} \sin\theta_i \tag{41}$$

where the indices correspond to the following:

ith - data point
kth - aircraft flight or satellite 10-day file
lth - magnetic component (r,θ,φ,F)
mth - data type (Project MAGNET or POGS)
nth - geomagnetic latitude band (equatorial or nonequatorial)

2.4 Inverse Modeling Mathematical Details

Although the modeling objective is to determine the spherical-harmonic Gauss coefficients associated with the magnetic field generated in the Earth's core as indicated in eqs. (7a), (7b), and (7c), the satellite magnetic field measurements consist of magnetic fields of core, ionosphere, and magnetosphere origins. Since, unlike the aircraft data, these data are temporally coherent, it is possible to spherically harmonic model the external fields measured by POGS as well as the internal fields. In so doing, we minimize the possibility of contaminating the internal Gauss coefficients with noise of external origin. Thus, the aircraft data are used to compute only the 168 internal Gauss coefficients to degree and order 12, while the POGS data are used to compute the 168 internal Gauss coefficients to degree and order 12, the 35 external Gauss coefficients to degree and order 5, and (following Langel and Estes [1985], Quinn et al. [1986], and Langel [1993]) the 3 external Gauss coefficients, associated with the so-called Ring current and monitored by the Dst Index, to degree and order 1. The internal Gauss coefficients of degree n and order m at time t are denoted as $g_{nm}(t)$ and $h_{nm}(t)$, while the external Gauss coefficients of degree n and order m at time t are denoted as $q_{nm}(t)$ and $s_{nm}(t)$. The external Gauss coefficients corresponding to the Ring current for degree n and order m at time t are denoted as $\alpha_{nm}(t)$ and $\beta_{nm}(t)$. Using this notation, the potential function that includes all three contributions to the observed field has the following form:

$$
\begin{aligned}
V(r,\theta,\varphi,t) &= a \sum_{n=1}^{N_I} \sum_{m=0}^{n} \left(\frac{a}{r}\right)^{n+1} \left[g_{nn}(t)\cos(m\varphi) + h_{nm}(t)\sin(m\varphi)\right] P_n^m(\theta) \\
&+ a \sum_{n=1}^{N_E} \sum_{m=0}^{n} \left(\frac{r}{a}\right)^{n} \left[q_{nm}(t)\cos(m\varphi) + s_{nm}(t)\sin(m\varphi)\right] P_n^m(\theta) \qquad (42) \\
&+ a\, Dst(\theta,t) \sum_{n=1}^{N_R} \sum_{m=0}^{n} \left(\frac{r}{a}\right)^{n} \left[\alpha_{nm}(t)\cos(m\varphi) + \beta_{nm}\sin(m\varphi)\right] P_n^m(\theta)
\end{aligned}
$$

where $N_I = 12$, $N_E = 5$, and $N_R = 1$.

Now, defining the coefficient set $\{C_l\}$ for $l = 1,2,\ldots,L$ such that:

$$
C_l = \left\{
\begin{array}{llcl}
g_{nn}; & for\ n(n+1)/2 + m & \leq l(n,m) \leq & L_g \\
h_{nm}; & for\ n(n-1)/2 + m + L_g & \leq l(n,m) \leq & L_h \\
q_{nm}; & for\ n(n+1)/2 + m + L_h & \leq l(n,m) \leq & L_q \\
s_{nm}; & for\ n(n-1)/2 + m + L_q & \leq l(n,m) \leq & L_s \\
\alpha_{nm}; & for\ n(n+1)/2 + m + L_s & \leq l(n,m) \leq & L_\alpha \\
\beta_{nm}; & for\ n(n-1)/2 + m + L_\alpha & \leq l(n,m) \leq & L_\beta
\end{array}
\right\} \qquad (43)
$$

where:

$$L_g = \frac{N_I(N_I+3)}{2} \tag{44a}$$

$$L_h = L_g + \frac{N_I(N_I+1)}{2} \tag{44b}$$

$$L_q = L_h + \frac{N_E(N_E+3)}{2} \tag{44c}$$

$$L_s = L_q + \frac{N_E(N_E+1)}{2} \tag{44d}$$

$$L_\alpha = L_s + \frac{N_R(N_R+3)}{2} \tag{44e}$$

$$L_\beta = L_\alpha + \frac{N_R(N_R+1)}{2} \tag{44f}$$

it is possible to put eq. (42) into the following form:

$$V(r,\theta,\varphi,t) = \sum_{l=1}^{L} C_l(t)\, Q_{vl}(r,\theta,\varphi,t) \tag{45}$$

where $L = L_\beta = 206$.

The corresponding geometric functions are:

$$Q_{vl}(r,\theta,\varphi,t) = \left\{ \begin{array}{ll} a\left(\frac{a}{r}\right)^{n+1} \cos(m\varphi)\, P_n^m(\theta)\,; & l(n,m) = \frac{n(n+1)}{2} + m \\ a\left(\frac{a}{r}\right)^{n+1} \sin(m\varphi)\, P_n^m(\theta)\,; & l(n,m) = \frac{n(n-1)}{2} + m + L_g \\ a\left(\frac{r}{a}\right)^{n} \cos(m\varphi)\, P_n^m(\theta)\,; & l(n,m) = \frac{n(n+1)}{2} + m + L_h \\ a\left(\frac{r}{a}\right)^{n} \sin(m\varphi)\, P_n^m(\theta)\,; & l(n,m) = \frac{n(n-1)}{2} + m + L_q \\ a D_{st}(\theta,t)\left(\frac{r}{a}\right)^{n} \cos(m\varphi)\, P_n^m(\theta)\,; & l(n,m) = \frac{n(n+1)}{2} + m + L_s \\ a D_{st}(\theta,t)\left(\frac{r}{a}\right)^{n} \sin(m\varphi)\, P_n^m(\theta)\,; & l(n,m) = \frac{n(n-1)}{2} + m + L_\alpha \end{array} \right\} \tag{46}$$

Taking the negative gradient of eq. (45) yields the magnetic field vector $\boldsymbol{B}(r,\theta,\varphi,t)$, with components:

$$B_r(r,\theta,\varphi,t) = \sum_{l=1}^{L} C_l Q_{rl}(r,\theta,\varphi,t) \tag{47a}$$

$$B_\theta(r,\theta,\varphi,t) = \sum_{l=1}^{L} C_l Q_{\theta l}(r,\theta,\varphi,t) \tag{47b}$$

$$B_\varphi(r,\theta,\varphi,t) = \sum_{l=1}^{L} C_l Q_{\varphi l}(r,\theta,\varphi,t) \tag{47c}$$

where:

$$Q_{rl}(r,\theta,\varphi,t) = -\frac{\partial Q_{Vl}(r,\theta,\varphi,t)}{\partial r} \tag{48a}$$

$$Q_{\theta l}(r,\theta,\varphi,t) = -\frac{1}{r}\frac{\partial Q_{Vl}(r,\theta,\varphi,t)}{\partial \theta} \tag{48b}$$

$$Q_{\varphi l}(r,\theta,\varphi,t) = -\frac{1}{r\sin\theta}\frac{\partial Q_{Vl}(r,\theta,\varphi,t)}{\partial \varphi} \tag{48c}$$

The Total Intensity, given in terms of these three components, is:

$$B_F(r,\theta,\varphi,t) = \sqrt{B_r(r,\theta,\varphi,t)^2 + B_\theta(r,\theta,\varphi,t)^2 + B_\varphi(r,\theta,\varphi,t)^2} \tag{49}$$

It is clearly nonlinear in terms of the Gauss coefficients C_l . Under the assumption that the Gauss coefficients vary slowly in time, eq. (49) may be linearized via Taylor expansion, yielding:

$$\delta B_F(r,\theta,\varphi,t) \cong \sum_{l=1}^{L} \delta C_l Q_{Fl}(r,\theta,\varphi,t) \tag{50}$$

where the δ indicates that a small variation of the indicated quantity is to be taken, and where the functions $Q_{Fl}(r,\theta,\varphi,t)$, defined as:

$$Q_{Fl}(r,\theta,\varphi,t) = \frac{B_r(r,\theta,\varphi,t)\, Q_{rl}(r,\theta,\varphi,t) + B_\theta(r,\theta,\varphi,t)\, Q_{\theta l}(r,\theta,\varphi,t) + B_\varphi(r,\theta,\varphi,t)\, Q_{\varphi l}(r,\theta,\varphi,t)}{B_F(r,\theta,\varphi,t)} \tag{51}$$

are evaluated at a fixed epoch t = τ. Thus, eq. (50) may be integrated, assuming $Q_{Fl}(r,\theta,\varphi,t)$ varies minimally with respect to small changes in the Gauss coefficients, to yield:

$$B_F(r,\theta,\varphi,t) \cong \sum_{l=1}^{L} C_l(t)\, Q_{Fl}(r,\theta,\varphi,t) \tag{52}$$

which is a useful form for setting up the least-squares problem to determine the Gauss coefficients.

Minimization of the chi-square function of eq. (35) requires that:

$$\delta\chi^2 = \sum_{j=1}^{206} \frac{\partial\chi^2}{\partial C_j}\,\delta C_j = 0 \tag{53}$$

which is satisfied when:

$$\frac{\partial\chi^2}{\partial C_j} = 0 \qquad\qquad j = 1,2,\ldots,206 \tag{54}$$

Therefore, we must have:

$$\frac{\partial\chi_r^2}{\partial C_j} + \frac{\partial\chi_\theta^2}{\partial C_j} + \frac{\partial\chi_\varphi^2}{\partial C_j} + \frac{\partial\chi_F^2}{\partial C_j} = 0 \qquad\qquad j = 1,2,\ldots,206 \tag{55}$$

which is a nonlinear system of 206 equations for the 206 unknown coefficients in the set $\{C_l\}$. This system of equations is nonlinear because χ^2 depends on B_F, which in turn depends nonlinearly on the Gauss coefficients through eq. (49) which depends on eq. (51). The individual terms in eq. (55) are determined from eqs. (37a) through (37d), eqs. (47a) through eqs. (47c), and eq. (52) and by taking the indicated derivatives with respect to the Gauss coefficients, so that:

$$\frac{\partial\chi_r^2}{\partial C_j} = \sum_{l=1}^{L} C_l \sum_{i=1}^{I_r} w_{ri}\, Q_{rl}(r_i,\theta_i,\varphi_i,\tau)\, Q_{rj}(r_i,\theta_i,\varphi_i,\tau) - \sum_{i=1}^{I_r} w_{ri}\, b_{ri}\, Q_{rj}(r_i,\theta_i,\varphi_i,\tau) \tag{56a}$$

$$\frac{\partial\chi_\theta^2}{\partial C_j} = \sum_{l=1}^{L} C_l \sum_{i=1}^{I_\theta} w_{\theta i}\, Q_{\theta l}(r_i,\theta_i,\varphi_i,\tau)\, Q_{\theta j}(r_i,\theta_i,\varphi_i,\tau) - \sum_{i=1}^{I_\theta} w_{\theta i}\, b_{\theta i}\, Q_{\theta j}(r_i,\theta_i,\varphi_i,\tau) \tag{56b}$$

$$\frac{\partial\chi_\varphi^2}{\partial C_j} = \sum_{l=1}^{L} C_l \sum_{i=1}^{I_\varphi} w_{\varphi i}\, Q_{\varphi l}(r_i,\theta_i,\varphi_i,\tau)\, Q_{\varphi j}(r_i,\theta_i,\varphi_i,\tau) - \sum_{i=1}^{I_\varphi} w_{\varphi i}\, b_{\varphi i}\, Q_{\varphi j}(r_i,\theta_i,\varphi_i,\tau) \tag{56c}$$

$$\frac{\partial \chi_F^2}{\partial C_j} = \sum_{l=1}^{L} C_l \sum_{i=1}^{I_F} w_{Fi}\{Q_{rl}(r_i,\theta_i,\varphi_i,\tau)\,Q_{rj}(r_i,\theta_i,\varphi_i,\tau) + Q_{\theta l}(r_i,\theta_i,\varphi_i,\tau)\,Q_{\theta j}(r_i,\theta_i,\varphi_i,\tau)$$

$$+ Q_{\varphi l}(r_i,\theta_i,\varphi_i,\tau)\,Q_{\varphi j}(r_i,\theta_i,\varphi_i,\tau)\} - \sum_{i=1}^{I_F} w_{Fi}\,b_{Fi}\,Q_{Fi}(r_i,\theta_i,\varphi_i,\tau) \tag{56d}$$

where eq. (51) has been used to obtain eq. (56d).

Inserting these expressions into eq. (55) yields the following system of equations:

$$\sum_{l=1}^{L} C_l\,\mathcal{Q}_{lj} = \mathcal{R}_j \qquad\qquad j = 1,2,\ldots,206 \tag{57}$$

where:

$$\mathcal{Q}_{lj} = \sum_{i=1}^{I_r} w_{ri}\,Q_{rl}(r_i,\theta_i,\varphi_i,\tau)\,Q_{rj}(r_i,\theta_i,\varphi_i,\tau) + \sum_{i=1}^{I_\theta} w_{\theta i}\,Q_{\theta l}(r_i,\theta_i,\varphi_i,\tau)\,Q_{\theta j}(r_i,\theta_i,\varphi_i,\tau)$$

$$+ \sum_{i=1}^{I_\varphi} w_{\varphi i}\,Q_{\varphi l}(r_i,\theta_i,\varphi_i,\tau)\,Q_{\varphi j}(r_i,\theta_i,\varphi_i,\tau) + \sum_{i=1}^{I_F} w_{Fi}\,\{Q_{rl}(r_i,\theta_i,\varphi_i,\tau)\,Q_{rj}(r_i,\theta_i,\varphi_i,\tau) \tag{58}$$

$$+ Q_{\theta l}(r_i,\theta_i,\varphi_i,\tau)\,Q_{\theta j}(r_i,\theta_i,\varphi_i,\tau) + Q_{\varphi l}(r_i,\theta_i,\varphi_i,\tau)\,Q_{\varphi j}(r_i,\theta_i,\varphi_i,\tau)\}$$

and

$$\mathcal{R}_j = \sum_{i=1}^{I_r} w_{ri}\,b_{ri}\,Q_{rj}(r_i,\theta_i,\varphi_i,\tau) + \sum_{i=1}^{I_\theta} w_{\theta i}\,b_{\theta i}\,Q_{\theta j}(r_i,\theta_i,\varphi_i,\tau) +$$

$$\sum_{i=1}^{I_\varphi} w_{\varphi i}\,b_{\varphi i}\,Q_{\varphi j}(r_i,\theta_i,\varphi_i,\tau) + \sum_{i=1}^{I_F} w_{Fi}\,b_{Fi}\,Q_{Fj}(r_i,\theta_i,\varphi_i,\tau) \tag{59}$$

This system of 206 linear algebraic equations can be written in matrix form as:

$$\mathbf{C}\,\mathcal{Q} = \mathcal{R} \tag{60}$$

which may be inverted to yield:

$$\mathbf{C} = \mathcal{Q}^{-1}\mathcal{R} \tag{61}$$

which is an estimate of the Gauss coefficients that best fit the observed data in least-squares sense.

Since the fourth term on the right-hand side of eq. (59) depends on the Gauss coefficients, it is necessary to solve eq. (60) iteratively. If ρ is the iteration index, then we may write the ρ*'th* iterative solution for the Gauss coefficients as:

$$\mathbf{C}^{(\rho)} \cong \mathcal{Q}^{-1}\mathcal{R}^{(\rho-1)} \qquad \rho = 1, 2, \ldots, \rho_{max} \tag{62}$$

where ρ_{max} is the maximum number of iterations, and where the WMM-90 (modified) model was used as the *initial guess*. Note that the $\mathcal{Q}$ matrix in eq. (58) is independent of the Gauss coefficients and so must be computed only once. One set of Gauss coefficients was computed via the above technique for each of the 14 model epochs specified in table 10.

SECTION 3

MODELING RESULTS

3.0 The WMM-92.5 (optimum) Model

As table 10 indicates, 14 World Magnetic Models were computed at distinct epochs covering the time frame from 1991.0 to about 1993.7. These models are given the designations WMD-01, WMD-02 . . . WMD-14. The internal coefficients are derived from both Project MAGNET and POGS data, while the external coefficients refer only to the POGS data. The internal Gauss coefficients g_{nm} corresponding to these models are listed in table 11 and are plotted as functions of time in figure 20. The internal Gauss coefficients h_{nm} corresponding to these models are given in table 12 and are plotted as a functions of time in figure 21. Also, the external Gauss coefficients q_{nm} and s_{nm} corresponding to these models are given in tables 13 and 14, respectively, while the external Gauss coefficients α_{nm} and β_{nm} , which were intended to extract any residual Ring-current effects not already accounted for by the direct removal of the *10-day mean* ionospheric correction field, a procedure that was primarily intended to eliminate Spread-F effects and Field-Aligned current effects, are listed in tables 15 and 16, respectively. These latter sets of coefficients are quite small, indicating that most of the magnetospheric Ring-current contribution was eliminated as part of the mean ionospheric correction. The set of external Gauss coefficients q_{nm} and s_{nm} is asymmetric in the sense that the former set of coefficients is considerably larger than the latter. It is not clear why this is so, although it is possible that the portion of the external field that normally contributes to the s_{nm} set of coefficients may also have been removed by the *10-day mean* ionospheric correction. In addition, the q_{nm} coefficient seem to exhibit a quasi-annual variation as one would expect.

The internal Gauss coefficients, as seen in figures 20 and 21, clearly exhibit essentially linear secular behavior. A few coefficients exhibit some small but noticeable external field contamination which also displays a quasi-annual variation. This contamination is perhaps most noticeable in the g_{30} coefficient, although in general the contamination is quite minimal. This quasi-annual external field contamination is detectable primarily as a consequence of the POGS data set longevity of nearly 3 years. The effects of this contamination can be eliminated via a weighted, linear least-squares fit of each internal Gauss coefficient. The weights come from the RMS statistics of each model with respect to all POGS and Project MAGNET data used to produce that model. Thus, we fit the 14 values of a single Gauss coefficient to a linear model of the form:

$$C_l(t) = C_l(T) + \dot{C}_l(t - T) \tag{63}$$

where the reference time T is chosen to be 1992.5. The coefficients $C_l(T)$ are then the MF values at 1992.5, while the coefficients $\dot{C}_l$ represent the SV coefficients at 1992.5. Performing this least squares fit on all of the internal Gauss coefficients yields the WMM-92.5 (*optimum*) model, the coefficients of which are listed in table 17. Using the SV portion of the WMM-92.5 model to adjust the MF coefficients of the same model backward 2.5 years yields a set of MF coefficients at the 1990.0 epoch, which, when merged with the WMM-92.5 (*optimum*) SV coefficients, yields the WMM-90 (*revised*) model listed in table 18.

Table 11. Schmidt Normalized Gauss Coefficients, for g, Modeled at 14 Epochs

		WMD 1	WMD 2	WMD 3	WMD 4	WMD 5	WMD 6	WMD 7	WMD 8	WMD 9	WMD 10	WMD 11	WMD 12	WMD 13	WMD 14
		1991.053	1991.092	1991.143	1991.404	1991.537	1991.702	1992.069	1992.364	1992.451	1992.530	1992.631	1993.097	1993.371	1993.530
n	m														
1	0	-29758.5	-29756.2	-29754.5	-29746.2	-29745.8	-29743.1	-29737.5	-29729.3	-29729.4	-29727.3	-29726.0	-29717.3	-29714.9	-29710.1
1	1	-1834.2	-1833.6	-1832.3	-1827.2	-1824.8	-1823.5	-1819.3	-1815.8	-1814.5	-1814.8	-1813.9	-1808.1	-1803.7	-1802.3
2	0	-2141.2	-2142.4	-2142.3	-2145.5	-2148.5	-2150.8	-2156.8	-2160.0	-2160.5	-2161.5	-2162.3	-2169.7	-2173.5	-2174.4
2	1	3064.4	3064.8	3064.5	3065.3	3066.0	3066.7	3067.4	3068.3	3068.9	3069.9	3069.8	3071.1	3071.7	3071.9
2	2	1687.3	1687.2	1687.1	1687.2	1687.5	1687.2	1687.6	1686.8	1686.8	1686.8	1686.8	1686.7	1686.5	1686.7
3	0	1309.3	1310.1	1310.6	1313.9	1313.3	1312.6	1313.1	1315.7	1314.0	1315.2	1316.0	1315.7	1315.6	1315.7
3	1	-2247.2	-2247.6	-2248.1	-2249.6	-2249.7	-2250.6	-2253.6	-2255.4	-2256.1	-2257.5	-2258.3	-2261.0	-2261.8	-2263.7
3	2	1248.7	1249.1	1249.3	1249.3	1248.8	1249.1	1248.0	1248.7	1248.5	1248.3	1248.1	1247.7	1247.6	1247.4
3	3	797.1	796.6	796.1	794.1	792.9	791.8	788.5	786.3	785.5	785.2	784.3	780.8	778.2	777.4
4	0	935.8	935.8	936.3	939.0	939.2	937.3	936.7	936.7	937.6	938.1	938.6	936.0	937.5	937.3
4	1	779.8	780.1	779.9	781.3	782.2	781.8	781.5	781.3	781.1	781.9	781.7	781.8	781.5	780.7
4	2	318.5	318.2	317.5	314.9	314.4	313.7	311.8	309.3	308.5	307.7	307.2	304.6	302.7	302.2
4	3	-420.9	-420.7	-420.7	-420.6	-420.6	-420.3	-420.5	-420.0	-420.1	-419.9	-419.8	-419.7	-419.4	-419.3
4	4	134.5	134.1	134.0	132.6	131.8	131.1	128.8	127.4	126.7	126.4	125.8	123.4	121.6	120.9
5	0	-213.7	-213.6	-213.8	-212.0	-211.2	-211.9	-211.3	-211.1	-212.0	-211.2	-210.4	-211.3	-210.3	-211.2
5	1	354.5	354.8	354.0	352.3	352.9	353.8	353.4	353.2	353.6	353.1	353.0	353.8	354.4	354.2
5	2	243.3	243.5	243.5	243.4	243.0	243.1	241.8	242.7	242.1	242.2	241.9	241.2	241.0	240.9
5	3	-112.3	-112.6	-113.0	-113.5	-113.8	-114.2	-115.6	-116.0	-116.1	-116.3	-116.7	-117.5	-118.3	-118.4
5	4	-162.6	-162.6	-162.7	-162.7	-162.7	-162.5	-162.5	-162.6	-162.4	-162.3	-162.2	-162.4	-162.4	-162.4
5	5	-32.1	-32.0	-31.9	-31.4	-31.2	-30.5	-29.8	-29.0	-28.7	-28.4	-28.2	-27.1	-26.3	-26.0
6	0	63.9	64.1	64.2	66.1	66.9	66.0	66.0	65.7	66.1	67.0	67.1	65.8	67.3	66.7
6	1	64.7	64.8	64.9	66.0	66.8	66.2	66.5	66.0	65.4	65.3	65.3	65.7	65.4	65.0
6	2	61.9	62.2	62.0	60.4	60.5	61.6	62.2	62.3	62.7	62.0	62.1	63.4	63.4	64.3
6	3	-177.1	-177.0	-177.0	-176.4	-176.2	-175.9	-175.3	-174.8	-174.7	-174.3	-173.8	-173.3	-172.7	-172.5
6	4	0.1	0.1	0.4	0.9	0.9	0.8	0.7	0.6	0.2	0.1	0.3	0.1	-0.3	-0.5
6	5	17.7	17.7	17.9	17.7	17.6	17.7	17.5	17.5	17.7	17.5	17.5	17.4	17.2	17.4
6	6	-92.0	-92.0	-92.0	-91.9	-91.9	-91.8	-91.7	-91.5	-91.5	-91.3	-91.3	-91.0	-91.0	-91.0
7	0	78.1	78.5	78.2	78.6	78.6	79.2	78.8	79.0	78.5	78.8	78.7	78.6	78.3	78.5
7	1	-63.9	-63.6	-64.1	-66.0	-66.1	-65.2	-65.7	-66.7	-66.2	-66.6	-67.0	-66.5	-66.4	-66.4

Table 11. Schmidt Normalized Gauss Coefficients, for g, Modeled at 14 Epochs (Con.)

		WMD 1	WMD 2	WMD 3	WMD 4	WMD 5	WMD 6	WMD 7	WMD 8	WMD 9	WMD 10	WMD 11	WMD 12	WMD 13	WMD 14
		1991.053	1991.092	1991.143	1991.404	1991.537	1991.702	1992.069	1992.364	1992.451	1992.530	1992.631	1993.097	1993.371	1993.530
n	m														
7	2	2.5	2.5	2.4	2.2	2.0	2.1	1.7	2.0	1.7	1.6	1.1	1.1	1.0	1.0
7	3	27.8	27.5	27.4	27.4	27.4	27.5	27.8	28.0	28.4	28.3	28.3	28.8	29.1	29.1
7	4	2.0	1.9	1.7	1.7	2.1	2.1	2.7	2.4	2.9	2.9	3.2	3.1	3.5	3.6
7	5	6.5	6.7	6.8	6.4	6.7	6.9	6.9	6.9	7.2	7.0	7.0	7.1	7.5	7.5
7	6	9.0	8.9	8.9	9.0	8.9	8.9	8.9	9.1	9.1	9.3	9.3	9.4	9.2	9.3
7	7	0.5	0.5	0.4	0.2	0.0	0.0	-0.2	-0.4	-0.5	-0.5	-0.6	-0.9	-1.1	-1.1
8	0	24.2	24.1	24.2	24.0	23.9	24.0	23.4	23.7	23.9	24.2	23.8	23.7	23.6	24.0
8	1	4.3	4.3	4.2	4.3	4.4	4.2	4.4	4.4	4.0	3.6	3.6	3.8	3.3	3.4
8	2	-0.5	-0.4	-0.5	-2.1	-2.5	-1.5	-1.2	-1.7	-1.1	-1.8	-1.9	-1.1	-1.7	-1.1
8	3	-10.7	-10.8	-10.6	-10.0	-10.0	-10.3	-10.1	-10.3	-10.3	-10.0	-9.8	-10.1	-10.1	-10.2
8	4	-13.5	-13.7	-13.6	-13.3	-13.2	-13.5	-13.5	-14.0	-14.4	-14.3	-14.1	-14.8	-14.8	-15.2
8	5	2.1	2.2	2.3	2.0	2.2	2.0	2.4	2.1	2.3	2.1	2.2	2.1	2.4	2.3
8	6	2.9	3.0	3.0	3.3	3.3	3.2	3.2	3.1	3.2	3.1	3.2	3.2	3.2	2.9
8	7	-1.6	-1.6	-1.7	-1.7	-1.9	-2.0	-2.3	-2.3	-2.5	-2.4	-2.4	-2.8	-3.2	-3.1
8	8	-7.3	-7.3	-7.3	-7.5	-7.5	-7.5	-7.5	-7.7	-7.7	-7.7	-7.8	-7.8	-7.9	-8.0
9	0	2.9	3.3	3.2	2.8	2.2	3.1	2.7	3.0	2.9	2.8	2.8	3.1	2.8	3.3
9	1	8.1	8.1	7.9	7.3	7.2	7.6	7.5	7.4	7.6	7.6	7.4	7.9	8.1	8.1
9	2	0.7	0.5	0.5	0.5	0.2	0.3	0.4	0.8	0.7	0.6	0.3	0.6	0.6	0.7
9	3	-10.2	-10.4	-10.1	-10.2	-10.5	-10.5	-10.4	-10.3	-10.1	-10.1	-10.0	-10.2	-10.3	-10.3
9	4	9.7	9.7	9.5	9.5	9.8	9.6	9.6	9.2	9.4	9.7	9.7	9.3	9.6	9.5
9	5	-2.2	-2.3	-2.2	-2.8	-2.5	-2.5	-2.1	-2.5	-2.4	-2.7	-2.8	-2.6	-2.4	-2.5
9	6	-2.3	-2.3	-2.4	-2.4	-2.3	-2.5	-2.3	-2.5	-2.4	-2.2	-2.3	-2.3	-2.1	-2.3
9	7	6.9	6.9	6.9	6.9	6.8	6.7	6.8	6.9	6.7	6.9	7.0	6.8	6.8	7.0
9	8	-0.5	-0.4	-0.5	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.5	-0.4	-0.4	-0.4
9	9	-6.5	-6.5	-6.5	-6.5	-6.5	-6.4	-6.4	-6.5	-6.5	-6.5	-6.5	-6.4	-6.4	-6.5
10	0	-2.7	-2.8	-2.7	-3.0	-3.1	-3.0	-3.4	-2.9	-2.8	-3.1	-3.3	-3.0	-3.0	-2.6
10	1	-3.3	-3.4	-3.4	-3.6	-3.4	-3.5	-3.2	-3.4	-3.4	-3.7	-3.5	-3.4	-3.7	-3.7
10	2	3.6	3.4	3.4	2.2	2.1	2.6	2.9	2.6	2.9	2.7	2.7	3.3	2.9	3.4
10	3	-4.5	-4.6	-4.4	-4.0	-4.1	-4.3	-4.3	-4.3	-4.4	-4.1	-3.9	-4.4	-4.4	-4.4
10	4	-3.0	-3.1	-3.1	-3.0	-2.8	-2.9	-3.1	-3.1	-3.1	-2.8	-2.8	-3.0	-2.9	-2.9

Table 11. Schmidt Normalized Gauss Coefficients, for g, Modeled at 14 Epochs (Con.)

		WMD 1	WMD 2	WMD 3	WMD 4	WMD 5	WMD 6	WMD 7	WMD 8	WMD 9	WMD 10	WMD 11	WMD 12	WMD 13	WMD 14
		1991.053	1991.092	1991.143	1991.404	1991.537	1991.702	1992.069	1992.364	1992.451	1992.530	1992.631	1993.097	1993.371	1993.530
n	m														
10	5	2.6	2.6	2.7	2.5	2.5	2.3	2.9	2.6	2.7	2.6	2.7	2.7	2.9	2.7
10	6	2.6	2.7	2.7	3.0	3.2	3.0	3.1	2.9	2.9	2.9	2.9	2.9	3.1	2.7
10	7	0.9	0.8	0.8	1.0	1.0	0.9	1.0	1.1	0.9	1.0	1.2	1.0	1.1	1.3
10	8	4.1	4.1	4.0	4.0	3.9	4.0	4.0	3.9	4.1	4.0	3.8	4.0	3.9	3.9
10	9	3.6	3.6	3.5	3.6	3.7	3.6	3.7	3.6	3.6	3.6	3.5	3.5	3.6	3.6
10	10	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.5	0.6	0.5	0.6	0.5
11	0	1.8	1.9	1.9	1.8	1.5	1.8	1.6	1.7	1.7	1.7	1.7	1.8	1.9	1.9
11	1	-1.4	-1.5	-1.5	-1.6	-1.5	-1.4	-1.3	-1.5	-1.5	-1.5	-1.5	-1.4	-1.1	-1.4
11	2	-3.3	-3.4	-3.4	-3.4	-3.5	-3.6	-3.6	-3.3	-3.3	-3.4	-3.4	-3.3	-3.2	-3.2
11	3	1.3	1.2	1.3	1.3	1.2	1.1	1.2	1.3	1.3	1.4	1.5	1.3	1.2	1.2
11	4	-0.7	-0.6	-0.7	-0.6	-0.5	-0.5	-0.7	-0.8	-0.8	-0.6	-0.6	-0.8	-0.7	-0.6
11	5	0.0	0.0	0.0	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.3	-0.4	-0.1	-0.5	-0.2
11	6	-0.7	-0.7	-0.7	-0.8	-0.7	-0.8	-0.7	-0.9	-0.8	-0.6	-0.7	-0.7	-0.7	-0.8
11	7	-0.8	-0.8	-0.8	-0.7	-0.8	-0.8	-0.7	-0.7	-0.9	-0.8	-0.6	-0.8	-0.7	-0.6
11	8	1.3	1.3	1.3	1.3	1.4	1.3	1.4	1.4	1.4	1.3	1.3	1.3	1.4	1.5
11	9	-0.3	-0.3	-0.3	-0.3	-0.2	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.4
11	10	2.1	2.1	2.1	2.2	2.3	2.2	2.2	2.1	2.2	2.1	2.1	2.2	2.1	2.1
11	11	4.1	4.1	4.1	4.1	4.2	4.1	4.1	4.1	4.1	4.1	4.1	4.0	4.0	4.0
12	0	-1.9	-1.9	-1.8	-1.7	-1.7	-1.8	-2.0	-1.6	-1.7	-1.8	-1.9	-1.8	-1.8	-1.7
12	1	0.4	0.5	0.6	0.7	0.8	0.8	0.8	0.5	0.6	0.4	0.4	0.4	0.1	0.0
12	2	0.1	0.1	0.2	-0.3	-0.3	-0.1	0.0	-0.2	-0.1	-0.1	-0.2	0.1	0.0	0.2
12	3	-0.6	-0.6	-0.5	-0.3	-0.3	-0.5	-0.4	-0.3	-0.4	-0.4	-0.2	-0.5	-0.3	-0.4
12	4	0.8	0.8	0.8	0.7	0.7	0.9	0.6	0.6	0.7	0.8	0.7	0.7	0.8	0.8
12	5	0.4	0.4	0.4	0.2	0.1	0.2	0.3	0.3	0.3	0.3	0.3	0.5	0.5	0.5
12	6	0.4	0.5	0.4	0.5	0.6	0.5	0.5	0.5	0.5	0.6	0.4	0.5	0.4	0.4
12	7	0.5	0.4	0.4	0.5	0.5	0.5	0.5	0.6	0.5	0.5	0.6	0.5	0.6	0.6
12	8	-0.3	-0.4	-0.4	-0.5	-0.6	-0.5	-0.5	-0.6	-0.4	-0.5	-0.6	-0.5	-0.5	-0.5
12	9	0.5	0.4	0.4	0.3	0.3	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.5	0.5
12	10	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.2	0.2	0.2	0.2	0.2	0.3	0.1
12	11	0.5	0.4	0.4	0.4	0.5	0.4	0.5	0.4	0.4	0.4	0.5	0.4	0.5	0.5
12	12	0.4	0.5	0.5	0.5	0.6	0.5	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.3

Table 12. Schmidt Normalized Gauss Coefficients, for h, Modeled at 14 Epochs

		WMD 1	WMD 2	WMD 3	WMD 4	WMD 5	WMD 6	WMD 7	WMD 8	WMD 9	WMD 10	WMD 11	WMD 12	WMD 13	WMD 14
		1991.053	1991.092	1991.143	1991.404	1991.537	1991.702	1992.069	1992.364	1992.451	1992.530	1992.631	1993.097	1993.371	1993.530
n	m														
1	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	1	5384.6	5384.5	5384.6	5380.6	5377.5	5374.9	5369.2	5363.1	5361.5	5359.4	5357.5	5349.5	5344.3	5340.5
2	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	1	-2297.7	-2298.6	-2299.8	-2304.6	-2307.1	-2309.4	-2314.0	-2318.2	-2319.7	-2320.8	-2323.1	-2329.9	-2333.9	-2336.1
2	2	-382.8	-382.9	-383.4	-386.2	-387.3	-389.0	-392.3	-395.4	-395.8	-397.0	-398.2	-402.8	-404.8	-406.2
3	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	1	-277.5	-276.9	-275.5	-272.9	-274.0	-273.0	-271.1	-270.0	-269.6	-269.9	-269.8	-267.5	-267.2	-266.9
3	2	293.3	293.1	293.3	294.1	294.3	294.4	295.2	296.1	295.9	296.6	296.7	297.6	297.9	298.4
3	3	-368.7	-369.0	-369.7	-372.4	-373.8	-376.1	-380.4	-384.3	-385.2	-386.4	-387.4	-393.4	-396.4	-398.7
4	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	1	252.7	252.3	252.0	251.3	251.0	251.9	253.3	254.9	254.5	254.7	254.7	256.4	256.6	257.3
4	2	-235.7	-235.4	-235.6	-236.2	-236.0	-235.5	-235.3	-234.8	-234.2	-234.2	-234.4	-234.0	-233.2	-232.2
4	3	88.5	88.5	88.6	89.3	89.9	90.2	91.1	92.0	92.1	92.8	92.8	94.1	95.3	95.6
4	4	-300.9	-300.8	-300.9	-301.2	-301.4	-301.8	-302.4	-302.8	-302.8	-303.0	-303.1	-303.9	-304.4	-304.5
5	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	1	42.2	42.3	42.7	44.0	43.4	43.0	43.0	43.0	43.4	43.0	42.7	43.1	43.2	43.1
5	2	153.9	153.5	153.8	154.7	154.5	154.3	154.4	155.7	155.2	156.0	156.0	156.4	156.0	156.5
5	3	-152.2	-152.1	-152.1	-151.3	-151.2	-151.2	-151.0	-151.1	-150.8	-151.1	-150.5	-150.7	-150.0	-150.6
5	4	-66.4	-66.3	-66.1	-65.3	-65.0	-64.7	-64.1	-63.6	-63.6	-63.6	-63.4	-62.3	-61.7	-61.5
5	5	100.7	100.8	100.9	101.4	101.5	101.6	101.7	102.2	102.3	102.2	102.2	102.7	102.9	103.2
6	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	1	-16.7	-16.7	-17.0	-17.4	-16.8	-16.7	-16.4	-15.9	-16.4	-16.5	-16.3	-15.6	-15.4	-15.4
6	2	80.3	80.4	80.1	79.1	79.0	78.9	78.0	77.4	77.6	77.5	77.4	76.4	76.0	76.5
6	3	71.0	70.7	70.7	70.5	70.7	70.8	70.0	70.4	70.2	70.9	70.5	70.5	70.3	70.4
6	4	-51.8	-51.8	-52.0	-52.4	-52.8	-52.6	-52.9	-53.2	-53.1	-53.1	-53.1	-53.3	-53.7	-53.6
6	5	-0.1	-0.2	-0.1	0.0	0.2	0.4	0.6	0.8	0.8	1.0	1.0	1.3	1.6	1.9
6	6	25.8	25.8	26.0	26.6	26.8	27.2	27.8	28.4	28.6	28.7	28.9	29.9	30.3	30.6
7	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	1	-78.2	-78.1	-78.2	-77.6	-77.1	-77.5	-77.4	-77.7	-77.3	-77.2	-77.4	-77.2	-76.2	-76.7

Table 12. Schmidt Normalized Gauss Coefficients, for h, Modeled at 14 Epochs (Con.)

		WMD 1	WMD 2	WMD 3	WMD 4	WMD 5	WMD 6	WMD 7	WMD 8	WMD 9	WMD 10	WMD 11	WMD 12	WMD 13	WMD 14
		1991.053	1991.092	1991.143	1991.404	1991.537	1991.702	1992.069	1992.364	1992.451	1992.530	1992.631	1993.097	1993.371	1993.530
n	m														
7	2	-25.8	-26.1	-25.9	-25.5	-25.4	-25.8	-25.5	-25.2	-25.4	-25.3	-25.4	-25.3	-25.2	-25.5
7	3	-0.8	-0.6	-0.6	-0.5	-0.3	-0.1	-0.3	-0.1	0.2	0.1	0.6	0.6	0.9	0.8
7	4	21.0	21.0	21.0	21.3	21.3	21.3	20.8	21.2	20.7	20.7	20.7	20.8	20.5	20.3
7	5	17.0	17.1	17.1	16.9	16.7	17.0	16.5	17.1	17.2	16.7	16.6	16.8	16.6	17.1
7	6	-22.8	-22.9	-22.8	-22.9	-22.9	-22.8	-23.0	-23.1	-23.0	-23.0	-23.2	-23.2	-23.3	-23.3
7	7	-4.5	-4.6	-4.5	-4.8	-5.1	-5.1	-5.4	-5.5	-5.6	-5.6	-5.7	-5.9	-6.3	-6.2
8	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	1	13.1	13.2	12.9	12.7	13.2	13.6	13.8	13.9	13.5	13.7	13.8	14.3	14.2	14.4
8	2	-18.4	-18.3	-18.3	-18.4	-18.1	-18.2	-18.2	-18.9	-18.6	-18.7	-18.6	-19.2	-18.6	-18.7
8	3	5.9	5.8	5.9	6.1	6.2	6.4	6.0	6.1	6.1	6.2	6.2	6.2	6.2	6.4
8	4	-22.5	-22.4	-22.5	-22.4	-22.5	-22.3	-22.2	-22.3	-21.9	-22.0	-21.9	-21.6	-21.7	-21.7
8	5	12.7	12.6	12.5	12.5	12.6	12.6	12.6	12.7	12.4	12.5	12.4	12.3	12.3	12.5
8	6	11.0	10.9	11.1	10.5	10.5	10.4	9.9	9.3	9.4	9.2	9.1	8.4	8.1	7.5
8	7	-17.3	-17.3	-17.2	-17.2	-17.4	-17.3	-17.5	-17.5	-17.6	-17.5	-17.6	-17.6	-17.7	-17.8
8	8	-6.2	-6.4	-6.4	-6.7	-7.0	-6.9	-7.2	-7.3	-7.4	-7.3	-7.4	-7.6	-7.9	-7.9
9	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9	1	-20.4	-20.1	-20.1	-19.9	-19.9	-19.9	-20.0	-20.6	-20.2	-20.1	-20.4	-20.3	-20.4	-20.6
9	2	14.2	14.1	14.2	14.3	14.4	14.2	14.5	14.2	14.2	14.2	14.0	14.1	13.7	13.6
9	3	11.4	11.4	11.4	10.7	10.7	11.1	11.3	11.0	11.2	11.0	11.4	11.6	11.5	11.6
9	4	-7.3	-7.4	-7.6	-7.4	-7.2	-7.1	-7.3	-7.0	-7.3	-7.4	-7.2	-7.1	-7.1	-7.2
9	5	-7.0	-6.8	-6.9	-7.0	-7.3	-7.1	-7.5	-7.1	-6.9	-7.3	-7.4	-7.3	-7.6	-7.1
9	6	9.3	9.1	9.2	9.0	9.4	9.3	9.4	9.1	9.3	9.3	9.0	9.1	9.2	9.0
9	7	7.6	7.7	7.8	7.7	7.6	7.6	7.4	7.6	7.6	7.5	7.6	7.4	7.6	7.6
9	8	-8.1	-8.1	-8.1	-8.0	-8.1	-8.1	-8.1	-8.0	-8.1	-8.0	-8.0	-8.0	-8.2	-8.1
9	9	2.8	2.7	2.7	2.6	2.5	2.7	2.6	2.7	2.7	2.8	2.7	2.8	2.8	2.8
10	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10	1	3.6	3.5	3.3	2.6	2.7	3.3	3.3	3.2	3.0	3.0	3.0	3.3	3.0	3.2
10	2	1.8	1.8	1.7	1.1	1.3	1.4	1.3	1.0	1.3	1.3	1.2	0.9	1.3	1.5
10	3	2.7	2.7	2.7	3.2	3.1	3.0	2.8	3.0	2.9	3.1	3.2	2.8	2.8	2.8

Table 12. Schmidt Normalized Gauss Coefficients, for h, Modeled at 14 Epochs (Con.)

		WMD 1	WMD 2	WMD 3	WMD 4	WMD 5	WMD 6	WMD 7	WMD 8	WMD 9	WMD 10	WMD 11	WMD 12	WMD 13	WMD 14
		1991.053	1991.092	1991.143	1991.404	1991.537	1991.702	1992.069	1992.364	1992.451	1992.530	1992.631	1993.097	1993.371	1993.530
n	m														
10	4	5.4	5.5	5.6	5.7	5.7	5.9	5.9	5.6	5.8	5.5	5.5	5.6	5.7	5.5
10	5	-3.4	-3.4	-3.5	-3.5	-3.5	-3.5	-3.4	-3.3	-3.5	-3.5	-3.5	-3.6	-3.6	-3.3
10	6	-0.9	-0.8	-0.7	-0.7	-0.5	-0.5	-0.4	-0.7	-0.5	-0.6	-0.5	-0.5	-0.6	-1.0
10	7	-2.8	-2.8	-2.8	-2.7	-2.6	-2.7	-2.6	-2.7	-2.8	-2.7	-2.5	-2.5	-2.4	-2.6
10	8	2.4	2.4	2.4	2.4	2.3	2.3	2.4	2.5	2.4	2.5	2.5	2.5	2.3	2.5
10	9	-1.7	-1.7	-1.6	-1.6	-1.6	-1.6	-1.6	-1.6	-1.6	-1.6	-1.7	-1.7	-1.7	-1.6
10	10	-6.6	-6.6	-6	-6.6	-6.7	-6.6	-6.6	-6.6	-6.6	-6.6	-6.6	-6.6	-6.5	-6.6
11	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11	1	-0.2	0.0	0.2	0.3	0.1	0.2	0.2	-0.3	-0.1	0.0	-0.2	-0.1	-0.4	-0.3
11	2	1.0	0.9	1.0	1.1	1.1	1.1	1.2	1.1	1.1	1.1	1.1	1.2	0.9	1.0
11	3	-3.1	-3.2	-3.3	-3.7	-3.7	-3.7	-3.4	-3.5	-3.3	-3.4	-3.2	-3.0	-3.2	-3.0
11	4	-1.6	-1.5	-1.6	-1.5	-1.4	-1.4	-1.6	-1.4	-1.5	-1.5	-1.6	-1.6	-1.7	-1.8
11	5	1.7	1.8	1.8	1.8	1.6	1.7	1.7	1.7	1.7	1.6	1.6	1.6	1.5	1.6
11	6	0.2	0.1	0.1	0.0	0.2	0.1	0.3	0.0	0.2	0.2	0.0	0.0	0.2	0.0
11	7	-1.3	-1.2	-1.3	-1.4	-1.3	-1.4	-1.4	-1.4	-1.3	-1.5	-1.4	-1.5	-1.2	-1.4
11	8	-2.4	-2.4	-2.4	-2.3	-2.3	-2.4	-2.2	-2.3	-2.4	-2.3	-2.3	-2.3	-2.3	-2.2
11	9	-0.7	-0.6	-0.6	-0.7	-0.8	-0.7	-0.8	-0.7	-0.7	-0.7	-0.8	-0.7	-0.9	-0.6
11	10	-2.2	-2.2	-2.2	-2.1	-2.2	-2.1	-2.1	-2.1	-2.1	-2.1	-2.1	-2.1	-2.2	-2.2
11	11	1.3	1.3	1.3	1.3	1.3	1.3	1.4	1.4	1.4	1.4	1.3	1.3	1.4	1.4
12	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12	1	0.7	0.6	0.5	0.0	-0.1	0.3	0.3	0.2	0.3	0.2	0.2	0.4	0.4	0.4
12	2	1.5	1.6	1.5	1.0	1.0	1.2	1.1	1.0	1.1	1.2	1.1	1.0	1.2	1.3
12	3	0.9	0.9	0.8	1.1	1.1	0.9	1.0	1.1	1.0	1.2	1.3	1.0	1.3	1.1
12	4	-3.0	-3.0	-3.0	-2.9	-2.9	-2.9	-2.8	-2.9	-2.9	-2.9	-2.9	-2.8	-2.9	-2.9
12	5	0.4	0.4	0.5	0.6	0.6	0.5	0.3	0.5	0.4	0.4	0.3	0.2	0.1	0.3
12	6	0.3	0.3	0.4	0.6	0.6	0.5	0.6	0.4	0.5	0.5	0.5	0.4	0.4	0.4
12	7	-0.9	-0.8	-0.8	-0.8	-0.7	-0.8	-0.7	-0.8	-0.9	-0.8	-0.7	-0.8	-0.6	-0.8
12	8	0.7	0.6	0.7	0.7	0.7	0.6	0.8	0.8	0.7	0.8	0.8	0.7	0.7	0.8
12	9	0.2	0.2	0.2	0.1	0.2	0.1	0.2	0.2	0.2	0.1	0.1	0.1	0.3	0.3
12	10	-1.4	-1.3	-1.4	-1.4	-1.4	-1.4	-1.4	-1.4	-1.4	-1.4	-1.4	-1.4	-1.5	-1.4
12	11	-0.4	-0.4	-0.4	-0.3	-0.3	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4
12	12	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9

Table 13. Schmidt Normalized External Gauss Coefficients, for q, Modeled at 14 Epochs

		WMD 01	WMD 02	WMD 03	WMD 04	WMD 05	WMD 06	WMD 07	WMD 08	WMD 09	WMD 10	WMD 11	WMD 12	WMD 13	WMD 14
		1991.053	1991.092	1991.143	1991.404	1991.537	1991.702	1992.069	1992.364	1992.451	1992.530	1992.631	1993.097	1993.371	1993.530
n	m														
1	0	17.6	16.2	14.2	10.0	12.0	14.1	14.3	11.5	14.6	11.1	11.5	11.2	12.5	13.8
1	1	-0.9	-0.1	-3.8	-7.6	-8.5	-7.6	-3.0	-4.8	-6.4	-2.7	-1.7	-3.1	-7.0	-3.2
2	0	1.4	2.5	1.3	-1.8	-1.0	1.0	2.0	2.7	0.9	0.3	-0.8	2.2	1.4	1.3
2	1	2.6	2.2	3.0	5.0	4.0	4.2	4.6	5.4	4.0	3.2	3.5	4.2	4.5	4.8
2	2	0.7	0.7	0.5	-0.4	-0.6	-0.6	-1.6	1.2	0.6	1.5	1.6	1.3	2.2	1.5
3	0	-5.2	-5.2	-4.2	-2.3	-3.7	-3.7	-5.0	-5.7	-5.1	-4.3	-5.5	-5.5	-6.6	-5.3
3	1	-2.2	-2.4	-1.1	1.3	0.9	0.3	0.0	-0.9	-0.2	-0.9	-0.8	-1.3	-1.9	-1.8
3	2	0.6	0.6	0.7	0.2	0.8	0.6	1.5	0.2	-0.2	0.0	0.4	0.6	0.5	0.1
3	3	0.2	0.3	1.1	0.7	0.5	0.4	0.9	1.3	1.7	0.6	0.7	0.9	1.7	0.9
4	0	1.8	1.2	0.8	-1.0	-1.1	-0.1	-0.1	0.8	0.4	-0.2	0.1	1.6	0.9	1.5
4	1	1.8	1.9	1.4	-1.8	-2.2	-1.3	-1.1	-0.7	-0.2	0.2	0.0	0.0	0.0	0.8
4	2	-1.4	-1.9	-2.0	-0.9	-1.1	-1.8	-1.6	-1.9	-1.6	-1.1	-1.2	-2.1	-1.7	-2.2
4	3	-0.6	-0.7	-0.5	0.1	0.0	-0.4	-0.6	-0.9	-0.3	-0.5	-0.4	-0.5	-0.9	-0.9
4	4	-0.1	0.2	-0.2	-0.5	-0.2	-0.3	0.2	-0.5	0.0	0.1	0.0	0.2	-0.4	0.0
5	0	1.5	1.4	1.1	0.4	0.5	0.3	1.0	1.2	1.6	0.9	1.0	1.4	2.1	1.5
5	1	0.3	0.1	-0.1	0.4	0.5	0.3	0.5	1.1	0.5	0.5	0.8	0.9	0.6	0.4
5	2	0.0	0.3	0.5	0.9	0.8	0.7	0.6	0.5	0.7	0.7	0.6	0.6	0.6	0.5
5	3	0.6	0.3	0.4	0.2	0.3	0.3	0.3	0.4	0.0	0.4	0.5	0.4	0.1	0.4
5	4	0.5	0.5	0.4	0.3	0.3	0.1	0.2	0.9	0.8	0.6	0.7	0.9	1.0	1.2
5	5	-0.4	-0.5	-0.5	-0.5	-0.6	-0.9	-0.5	-0.3	-0.4	-0.5	-0.7	0.3	-0.5	0.0

Table 14. Schmidt Normalized External Gauss Coefficients, for s, Modeled at 14 Epochs

		WMD 01	WMD 02	WMD 03	WMD 04	WMD 05	WMD 06	WMD 07	WMD 08	WMD 09	WMD 10	WMD 11	WMD 12	WMD 13	WMD 14
		1991.053	1991.092	1991.143	1991.404	1991.537	1991.702	1992.069	1992.364	1992.451	1992.530	1992.631	1993.097	1993.371	1993.530
n	m														
1	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	1	-0.7	-0.4	-0.4	-0.5	-0.5	-0.4	-0.3	-0.4	-0.5	-0.6	-0.8	-0.9	-0.8	-0.9
2	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	1	-0.8	-0.9	-0.5	0.2	0.1	-0.1	-0.3	-0.6	-0.4	-0.5	-0.4	-0.6	-0.5	-0.8
2	2	0.0	0.0	0.1	0.1	0.1	0.2	0.0	0.5	0.2	0.3	0.3	0.4	0.2	0.2
3	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	1	0.1	0.3	0.1	0.0	0.0	0.1	0.0	0.2	0.2	0.1	-0.1	-0.1	0.1	0.2
3	2	-0.2	-0.2	-0.3	-0.2	-0.2	-0.2	-0.3	-0.3	-0.3	-0.3	-0.4	-0.4	-0.4	-0.3
3	3	-0.1	-0.2	-0.1	0.0	-0.1	-0.1	-0.2	-0.3	-0.5	-0.3	-0.2	-0.3	-0.4	-0.9
4	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	1	0.3	0.1	0.0	0.0	0.1	0.3	0.3	0.4	-0.2	0.2	0.2	0.0	0.3	0.2
4	2	-1.1	-1.3	-0.9	-0.2	-0.4	-0.6	-0.9	-1.1	-1.0	-0.7	-0.8	-1.0	-1.2	-1.1
4	3	0.0	0.0	0.2	0.5	0.5	0.3	0.2	0.2	0.2	0.2	0.0	0.0	-0.1	0.0
4	4	-0.2	-0.2	-0.3	-0.5	-0.4	-0.3	-0.2	-0.5	-0.5	-0.4	-0.3	-0.3	-0.3	-0.3
5	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	1	0.2	0.3	0.3	0.2	0.2	0.3	0.3	0.3	0.2	0.3	0.4	0.4	0.4	0.3
5	2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.2	0.1	0.2	0.3	0.2	0.2	0.1
5	3	0.4	0.5	0.5	0.4	0.4	0.5	0.6	0.6	0.6	0.5	0.6	0.4	0.5	0.6
5	4	0.1	0.0	-0.1	0.1	0.1	0.1	0.2	0.0	0.0	-0.1	0.1	0.1	0.1	0.1
5	5	-0.6	-0.6	-0.2	-0.5	-0.6	-0.3	-0.6	-0.8	-0.1	-0.6	-0.9	-0.6	-0.8	-0.8

Table 15. **Dst Correction Coefficients, for α, Modeled at 14 Epochs**

		WMD 01	WMD 02	WMD 03	WMD 04	WMD 05	WMD 06	WMD 07	WMD 08	WMD 09	WMD 10	WMD 11	WMD 12	WMD 13	WMD 14
		1991.053	1991.092	1991.143	1991.404	1991.537	1991.702	1992.069	1992.364	1992.451	1992.530	1992.631	1993.097	1993.371	1993.530
n	m														
1	0	-0.06	0.01	-0.18	-0.05	-0.02	-0.03	0.02	-0.02	-0.08	-0.01	-0.02	-0.15	-0.13	-0.06
1	1	-0.06	-0.07	-0.11	0.04	-0.01	0.02	0.06	0.05	0.05	0.02	0.06	-0.01	-0.13	0.03

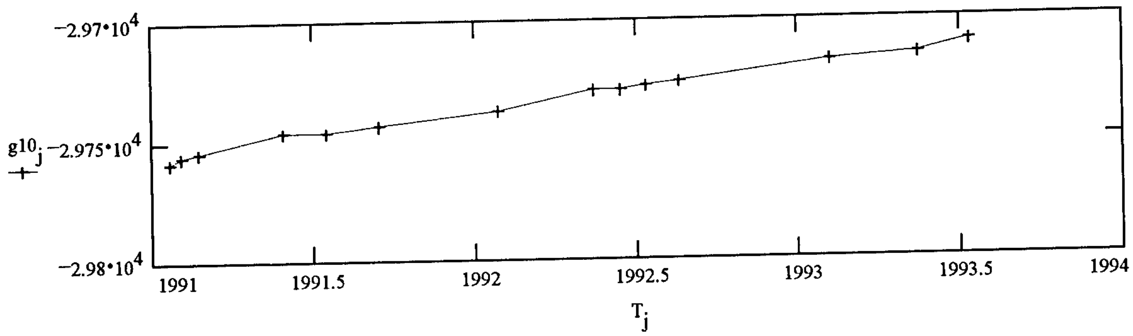
Table 16. **Dst Correction Coefficients, for β, Modeled at 14 Epochs**

		WMD 01	WMD 02	WMD 03	WMD 04	WMD 05	WMD 06	WMD 07	WMD 08	WMD 09	WMD 10	WMD 11	WMD 12	WMD 13	WMD 14
		1991.053	1991.092	1991.143	1991.404	1991.537	1991.702	1992.069	1992.364	1992.451	1992.530	1992.631	1993.097	1993.371	1993.530
n	m														
1	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1	1	-0.07	0.02	-0.02	0.05	0.05	0.09	0.12	0.01	0.08	0.06	-0.02	0.08	0.00	-0.02

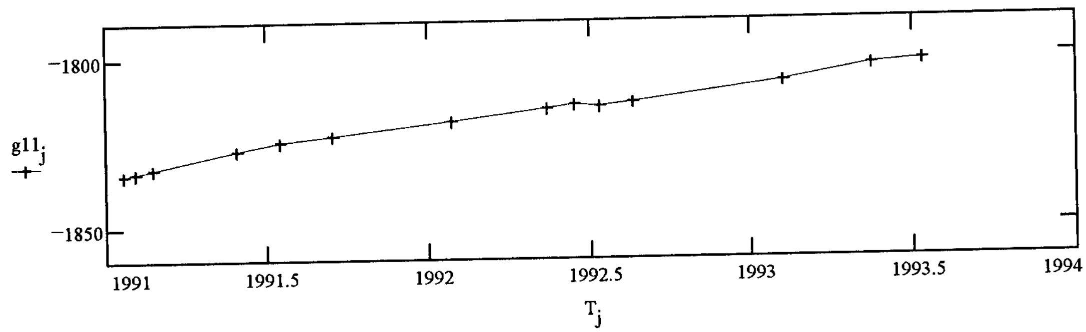
FIGURE 20.

GEOMAGNETIC SPHERICAL-HARMONIC COEFFICIENTS g_{nm} VERSUS TIME
(units: nT)

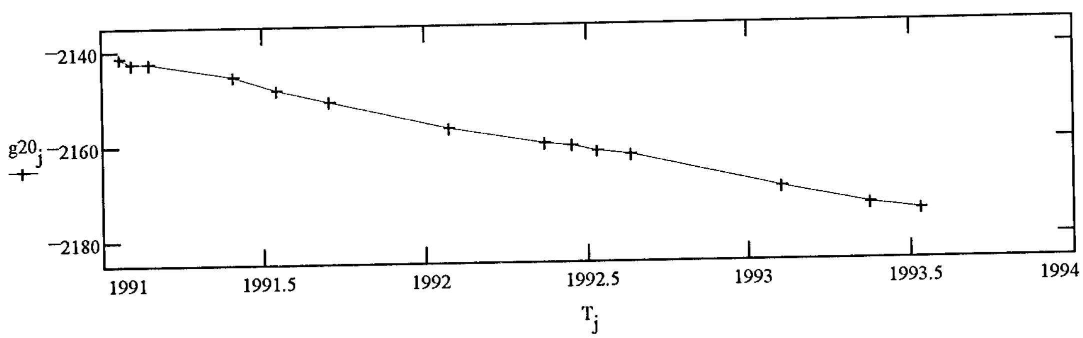
(Pages 187-206)



−2.97•10^4
g10_j −2.975•10^4
−2.98•10^4
1991
1991.5
1992
1992.5
1993
1993.5
1994
T_j



−1800
g11_j
−1850
1991
1991.5
1992
1992.5
1993
1993.5
1994
T_j



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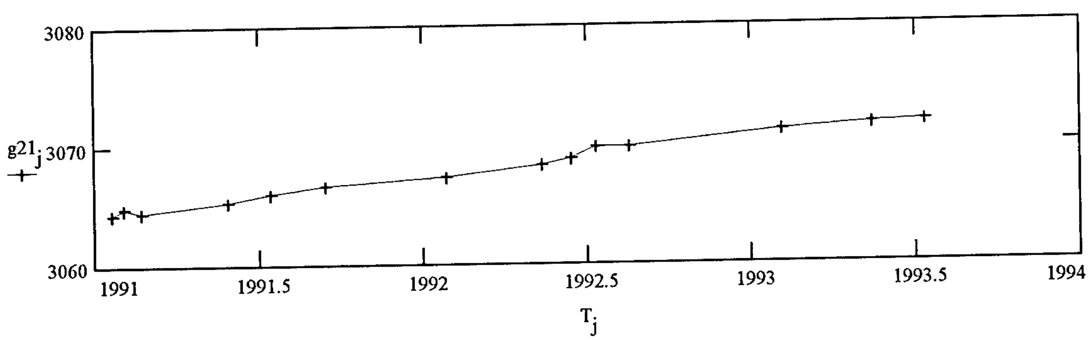
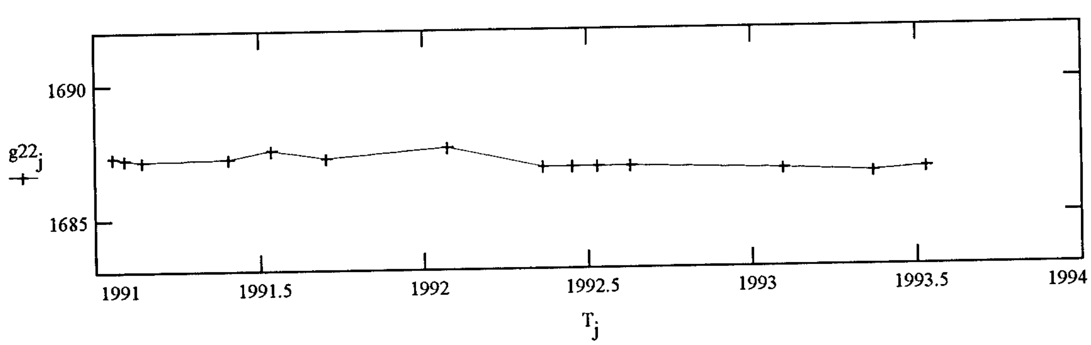
g20_j −2160
−2180
1991
1991.5
1992
1992.5
1993
1993.5
1994
T_j



3080
g21_j 3070
3060
1991
1991.5
1992
1992.5
1993
1993.5
1994
T_j



1690
g22_j
1685
1991
1991.5
1992
1992.5
1993
1993.5
1994
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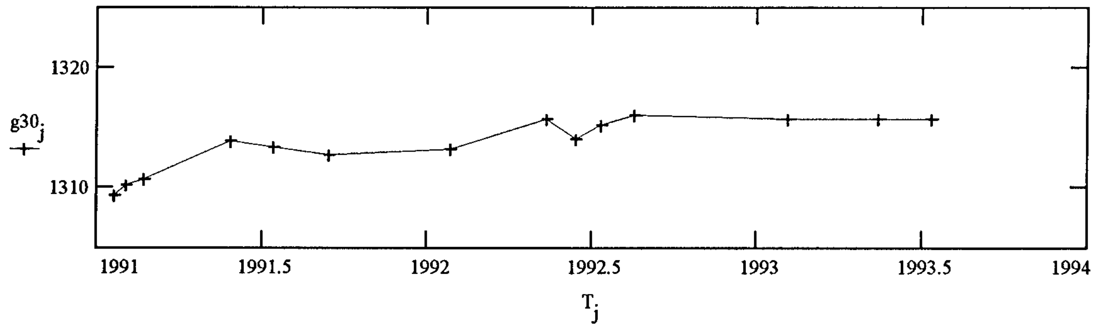
1320
1310
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1991
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1992
1992.5
1993
1993.5
1994
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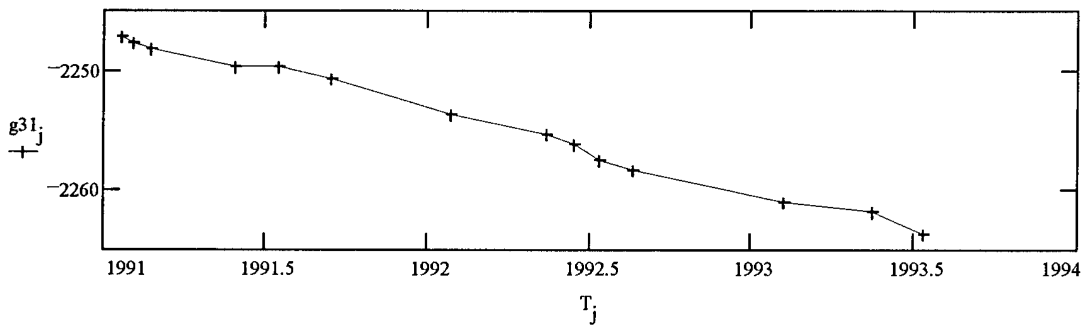
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g31_j
1991
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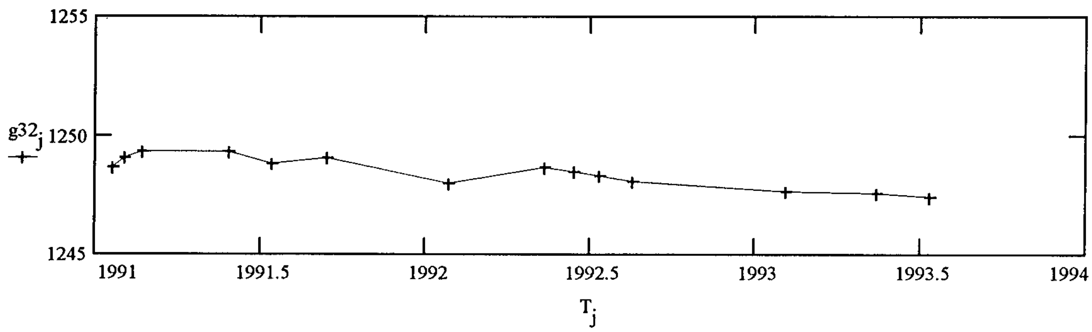
1993
1993.5
1994
T_j


1255
1250
1245
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1991
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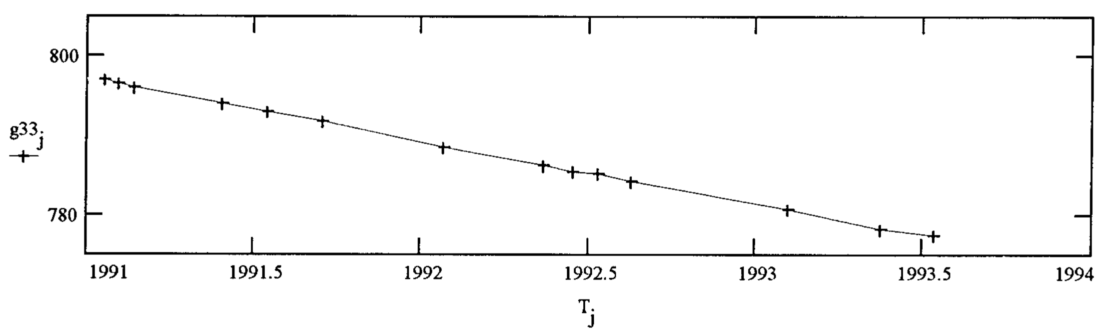
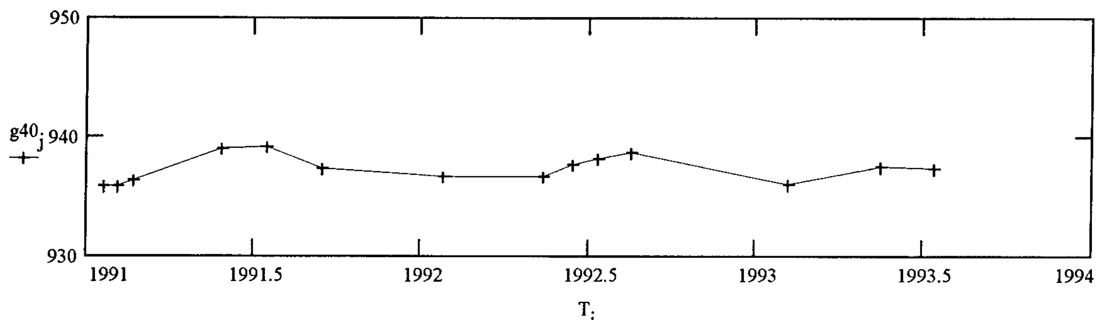
1992
1992.5
1993
1993.5
1994
T_j


800
780
g33_j
1991
1991.5
1992
1992.5
1993
1993.5
1994
T_j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940
930
g40_j
1991
1991.5
1992
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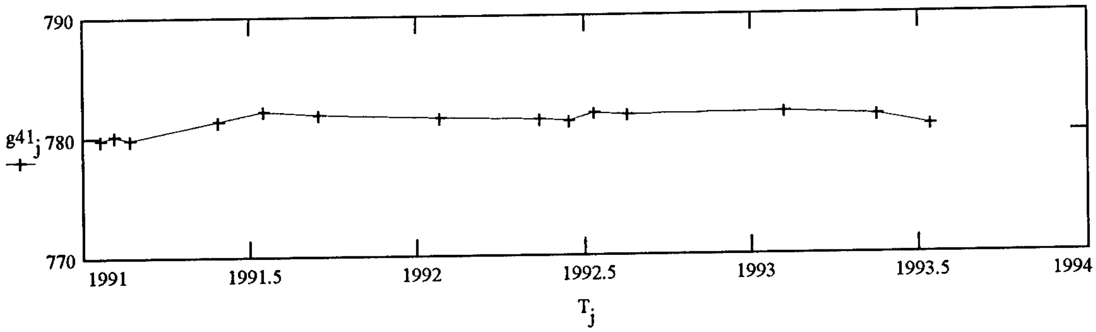
1993
1993.5
1994
T_j


790
780
770
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1991
1991.5
1992
1992.5
1993
1993.5
1994
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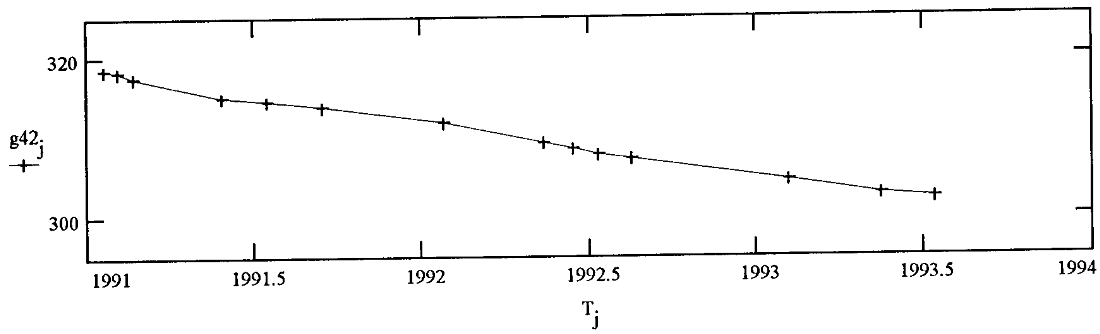
320
300
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1991
1991.5
1992
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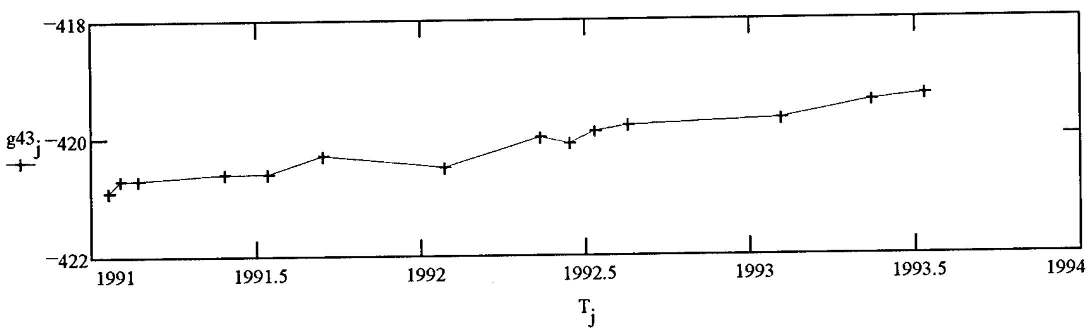
1993
1993.5
1994
T_j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−422
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1991
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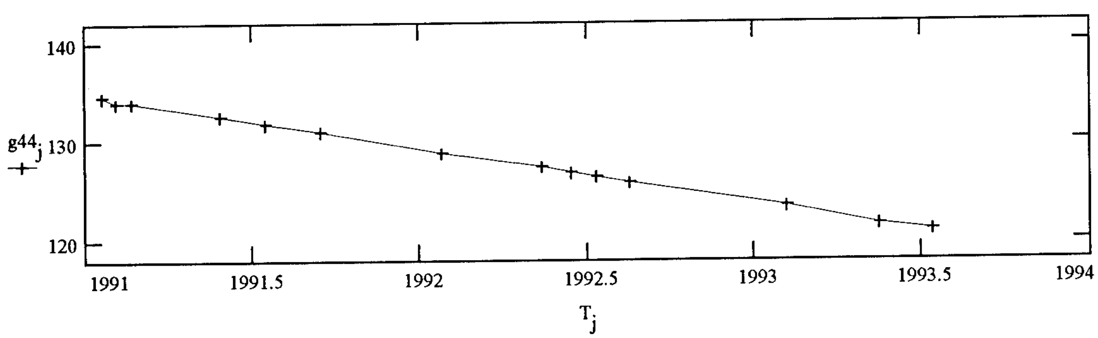
1992
1992.5
1993
1993.5
1994
T_j


140
130
120
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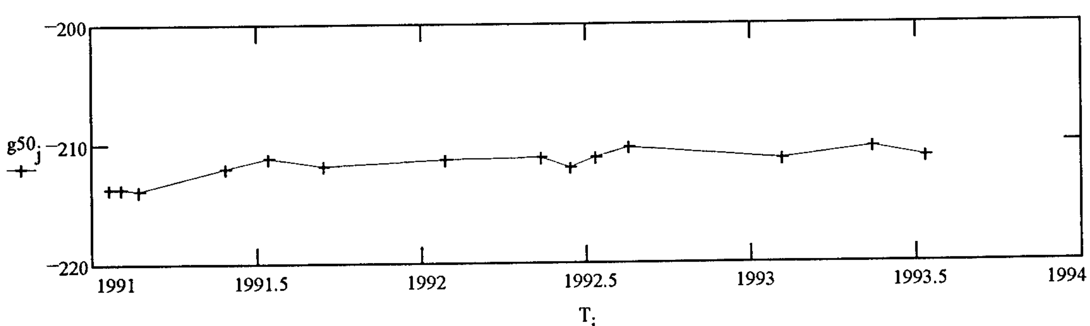
1991
1991.5
1992
1992.5
1993
1993.5
1994
T_j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−210
−220
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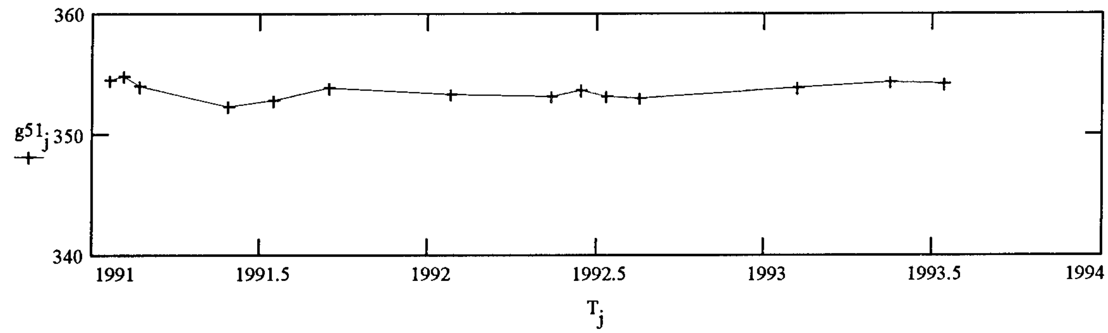
1991
1991.5
1992
1992.5
1993
1993.5
1994
T_j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g51j 350
340
1991
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1992
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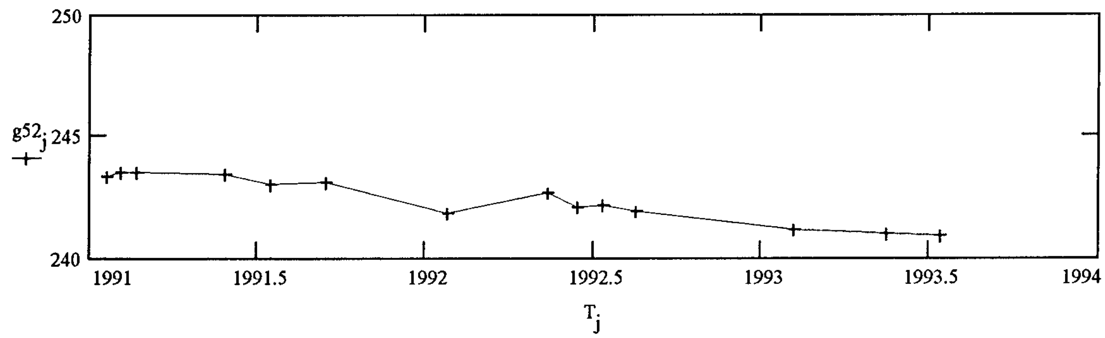
1993
1993.5
1994
Tj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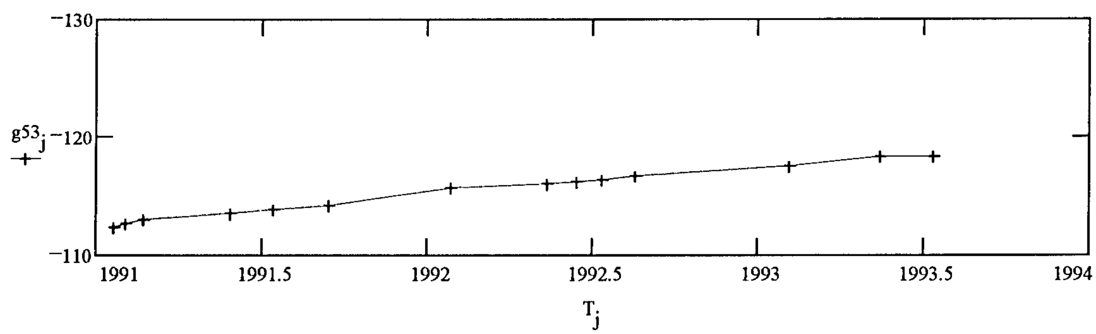
1994
Tj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1991
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1993.5
1994
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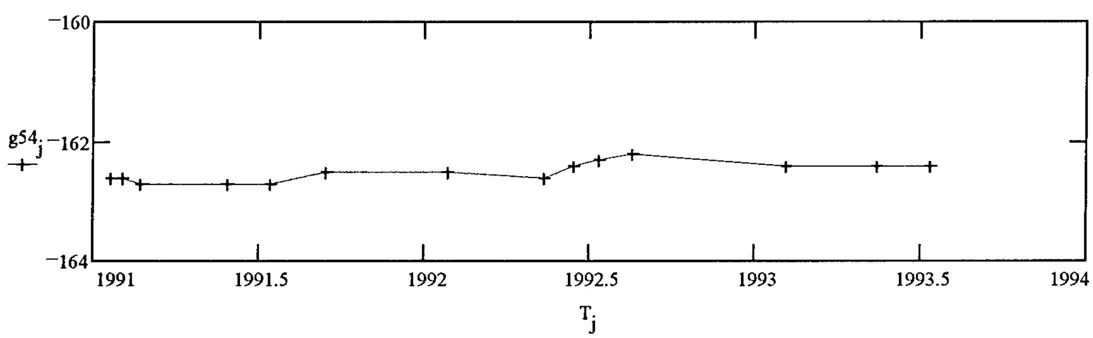
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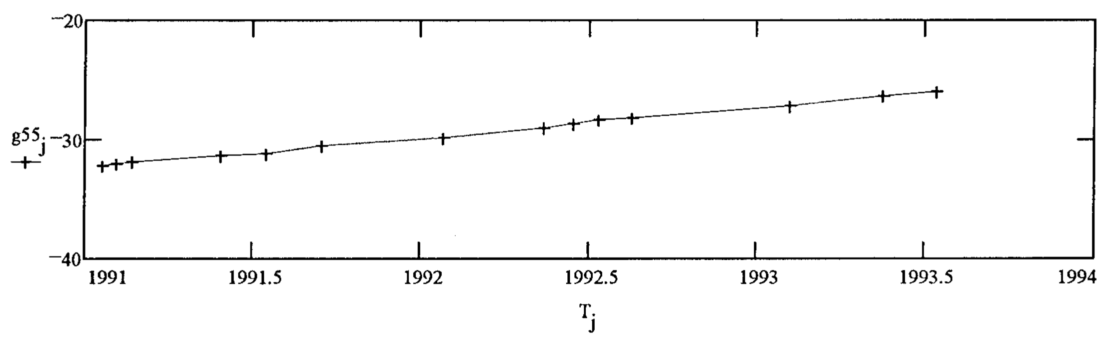
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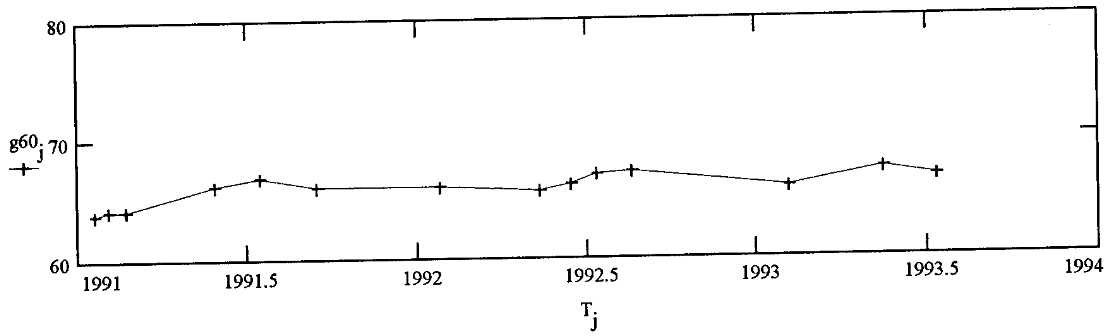
80
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60
1991
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1992.5
1993
1993.5
1994
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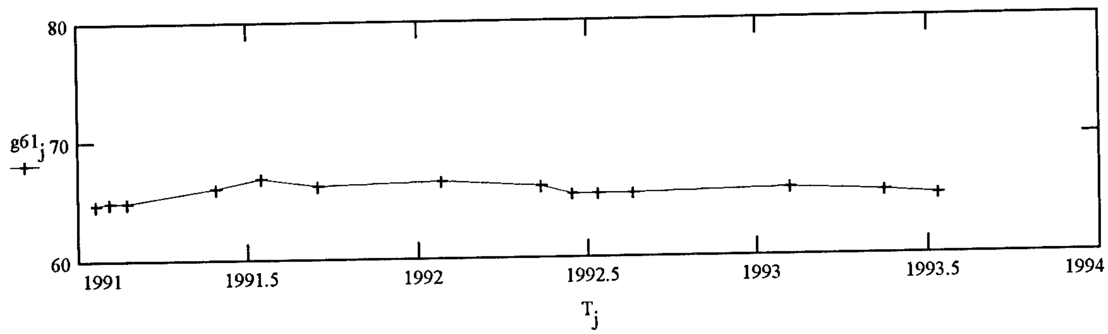
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1991
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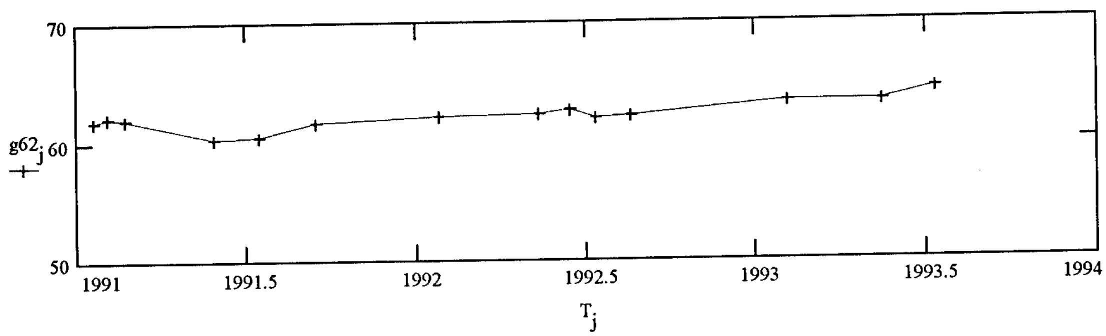
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1991
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1993.5
1994
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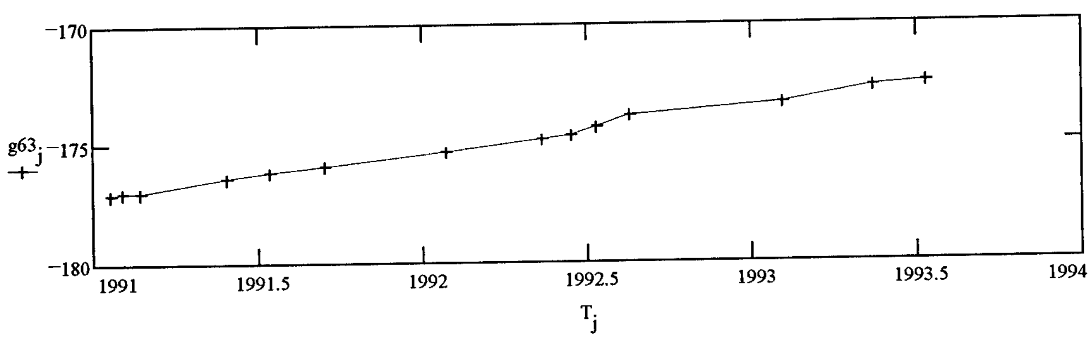
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1993.5
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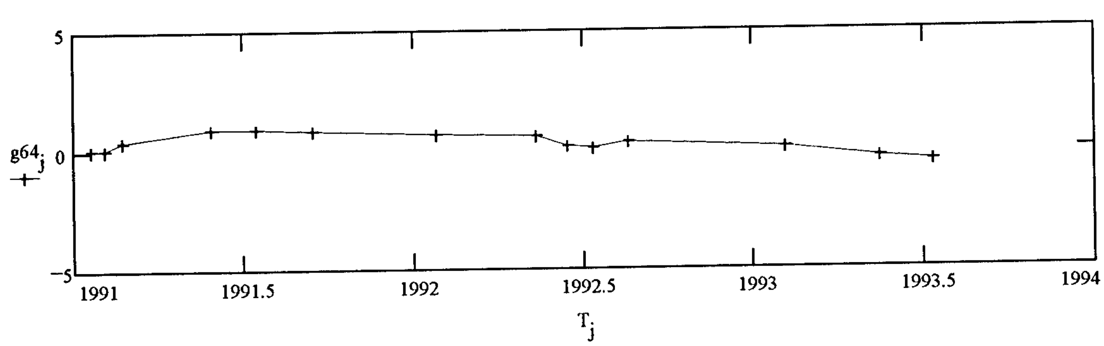
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1994
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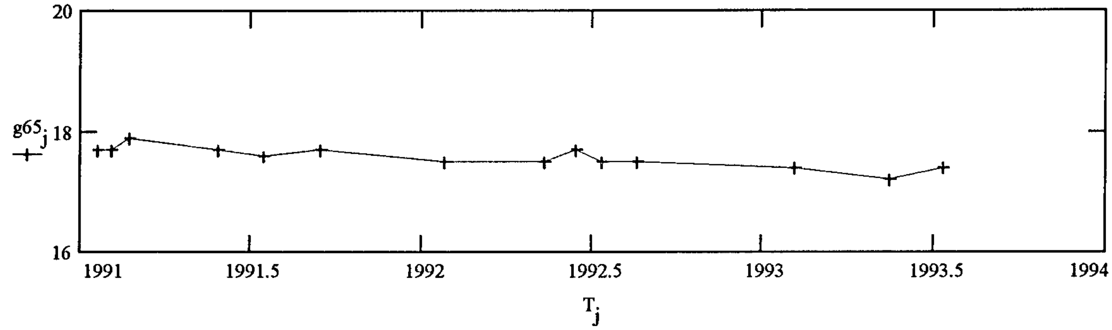
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16
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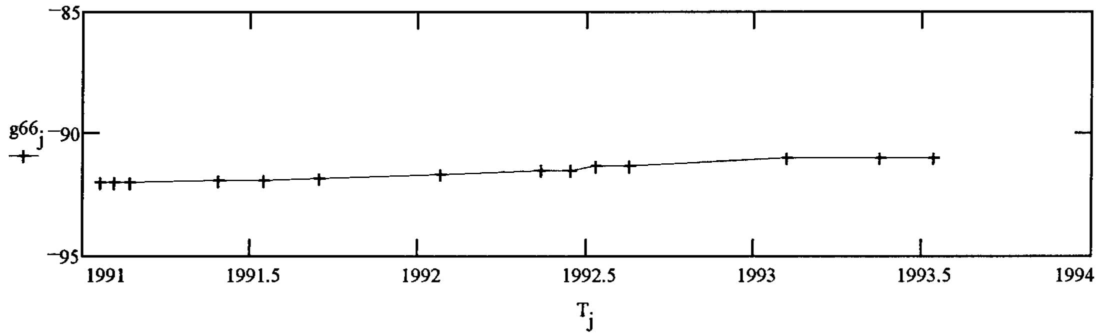
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−90
−95
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1993
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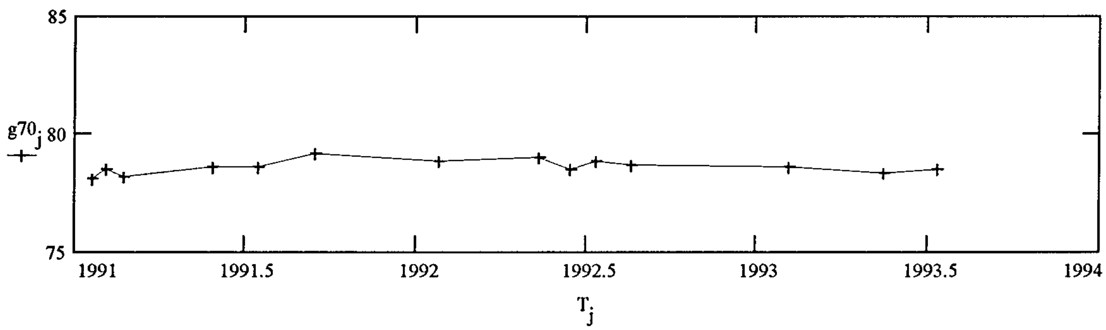
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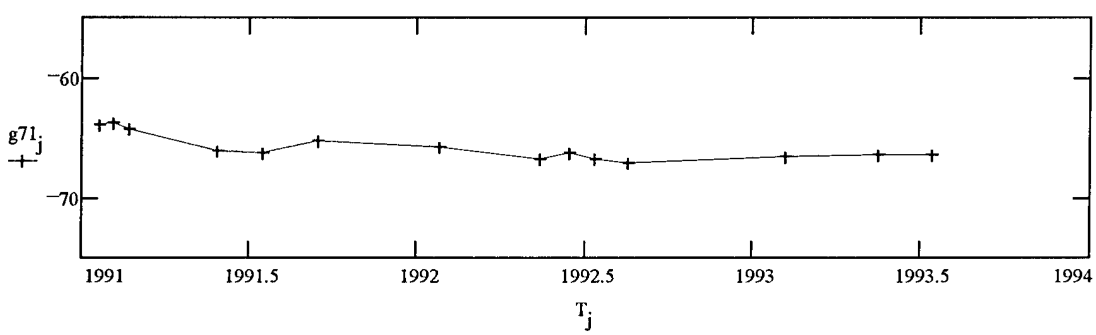
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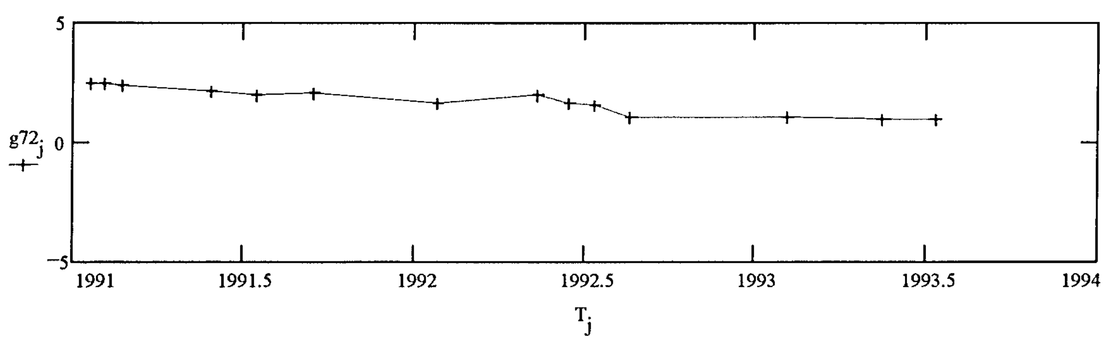
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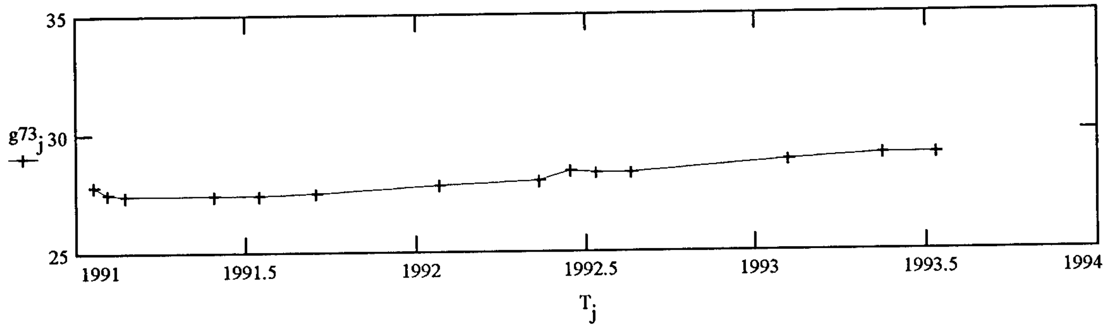
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25
1991
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1993.5
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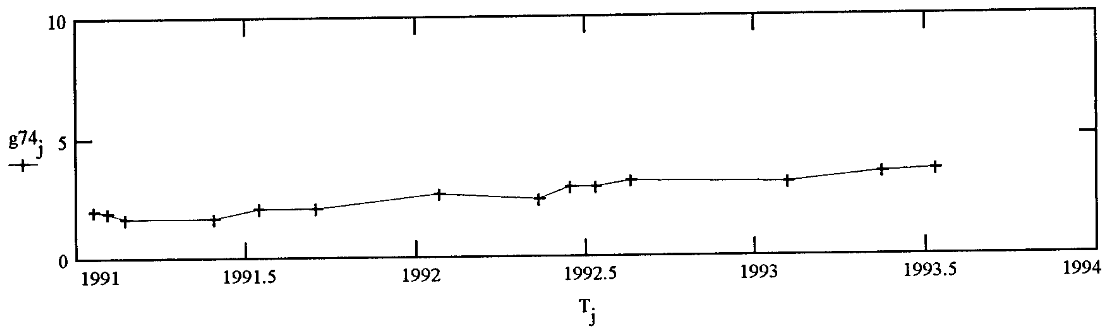
T_j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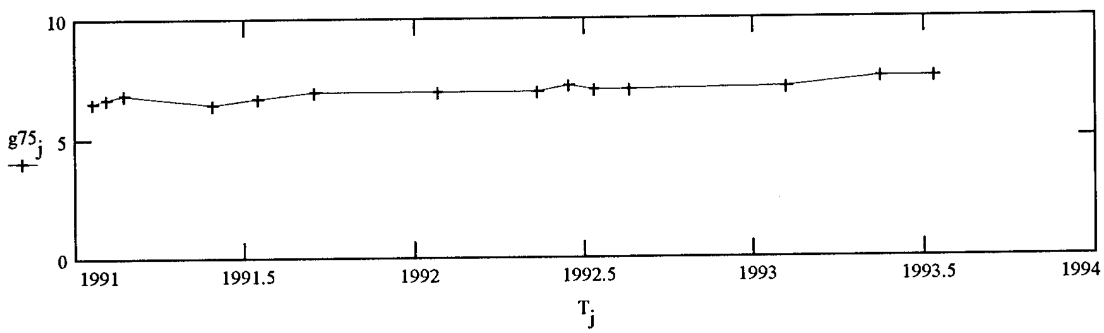
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1992
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1993
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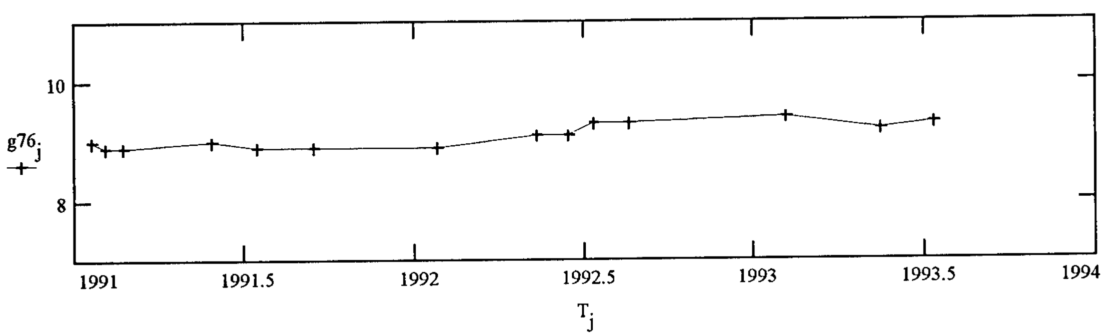
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8
1991
1991.5
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1993
1993.5
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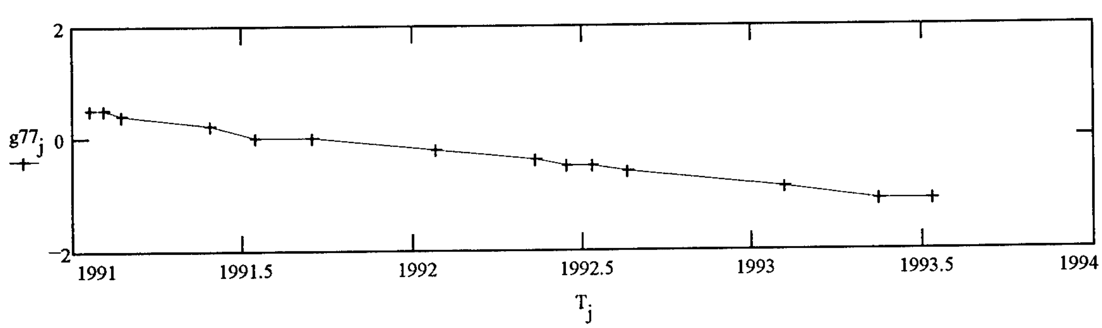
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1991
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1992
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1993
1993.5
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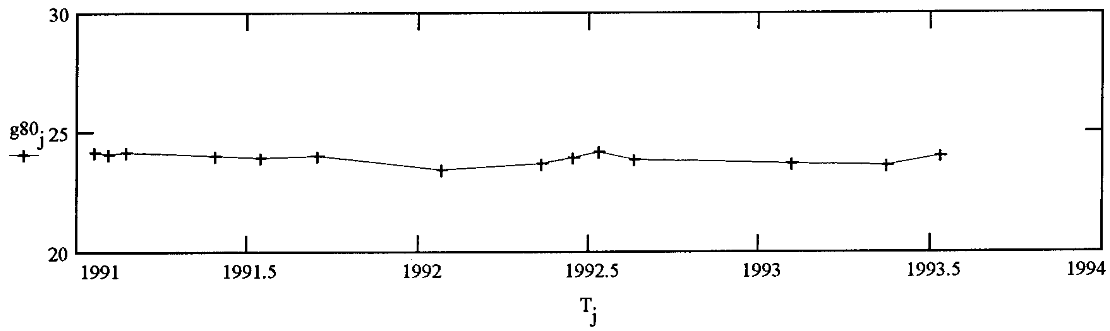
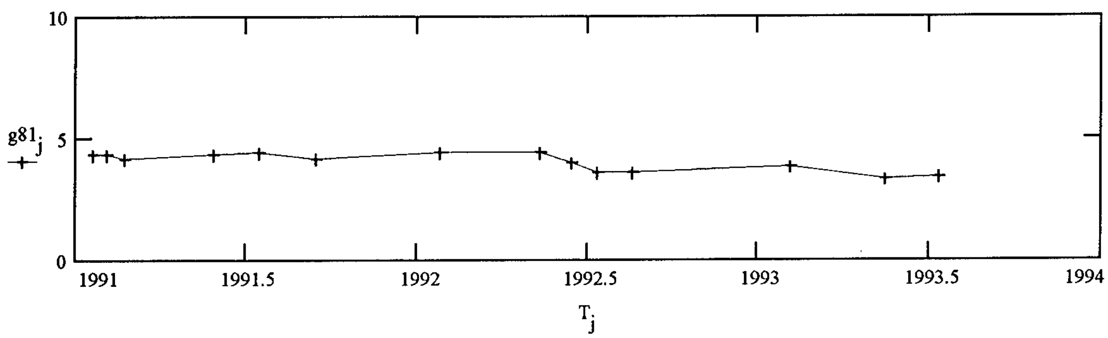

30
25
20
g80j
1991
1991.5
1992
1992.5
1993
1993.5
1994
Tj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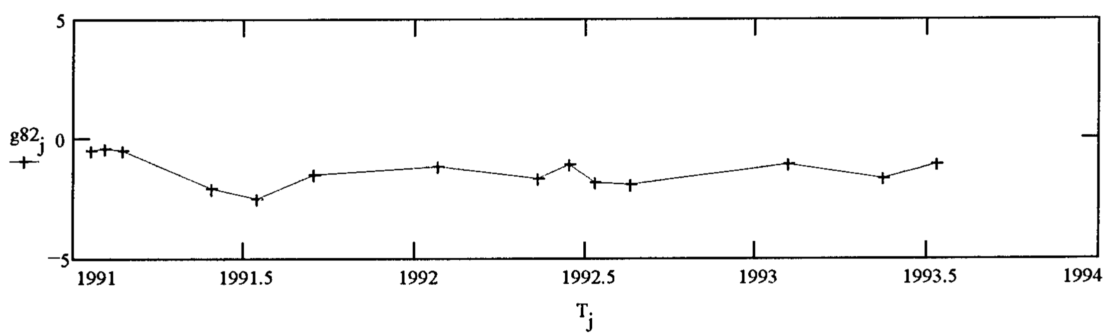
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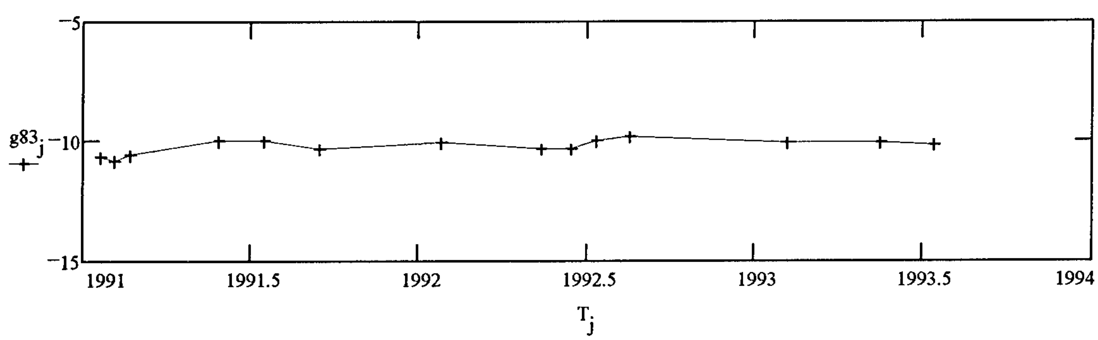
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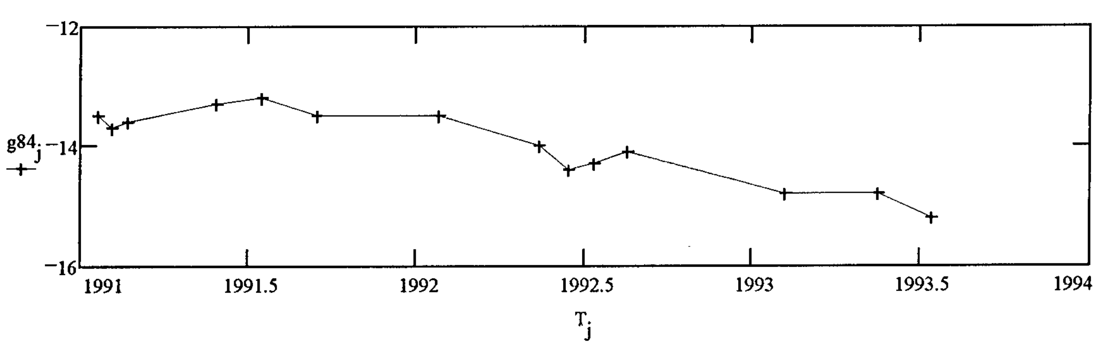
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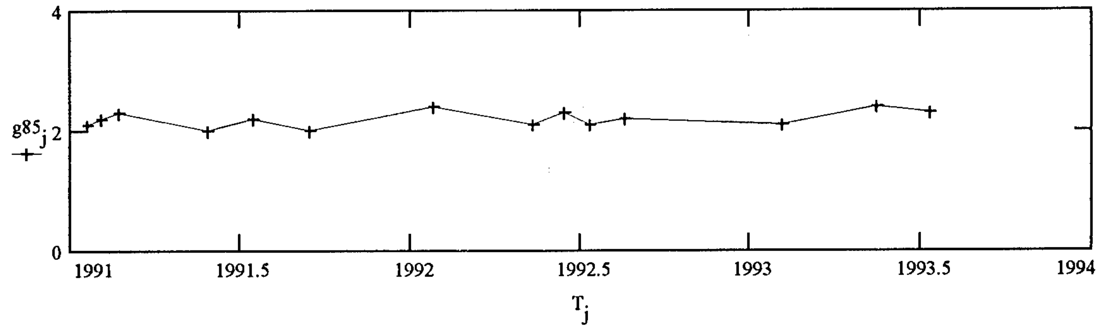
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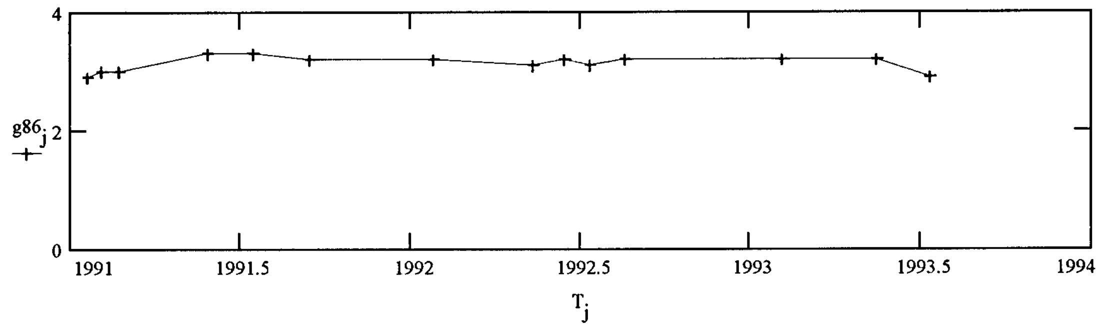
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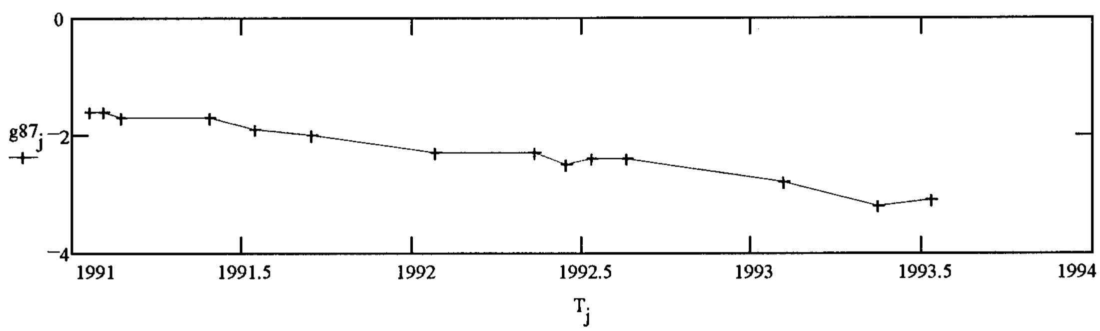
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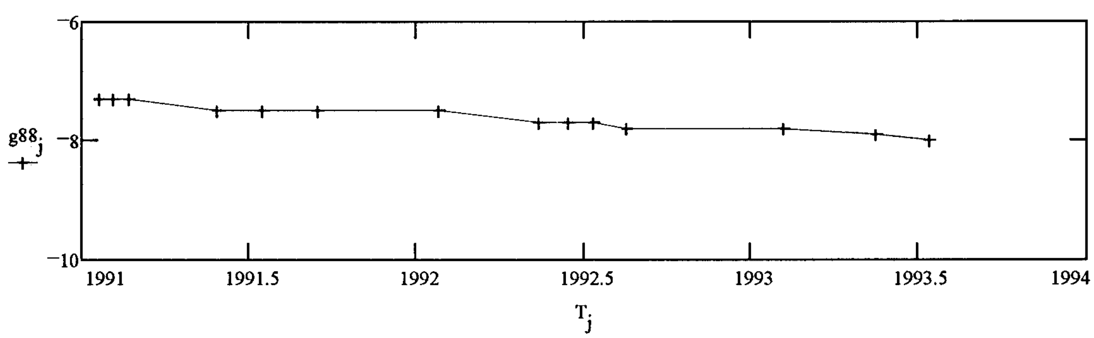
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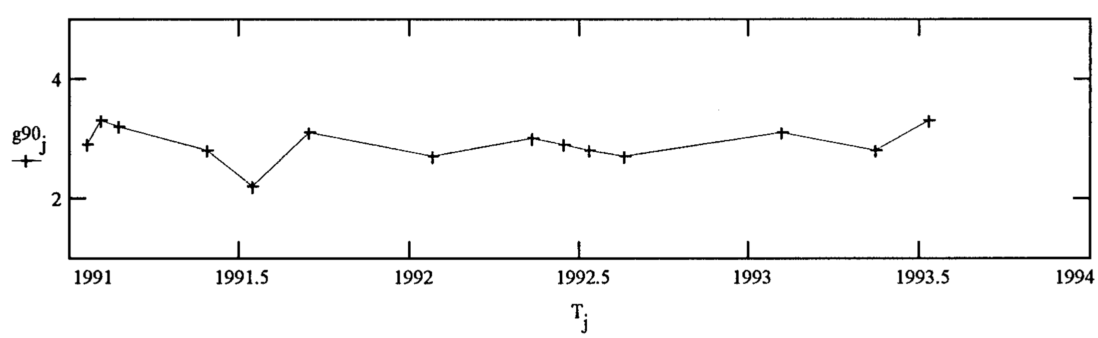
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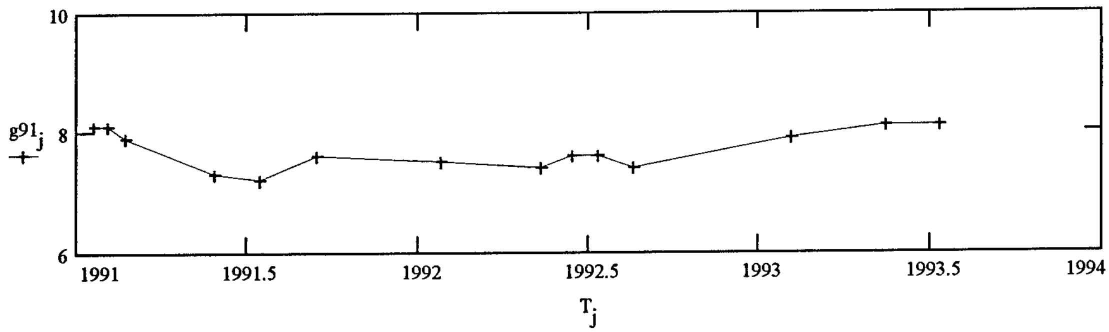
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6
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j
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1993.5
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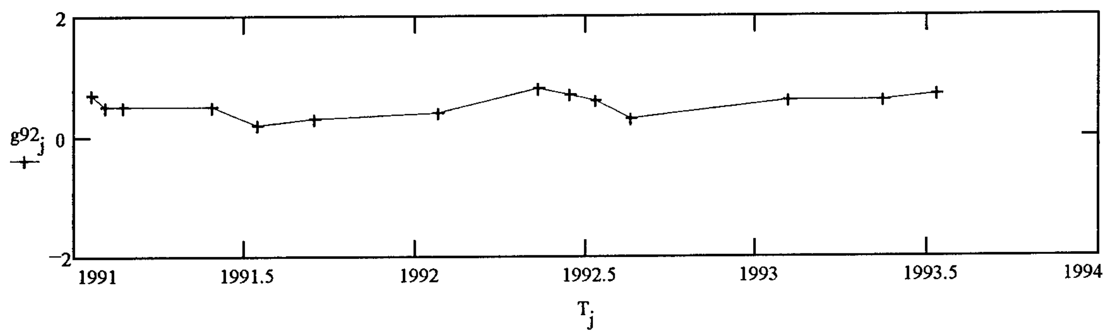
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T
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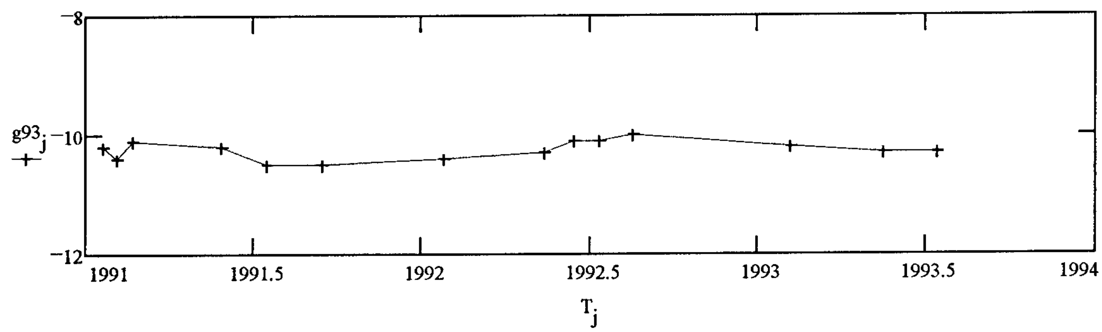
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1993.5
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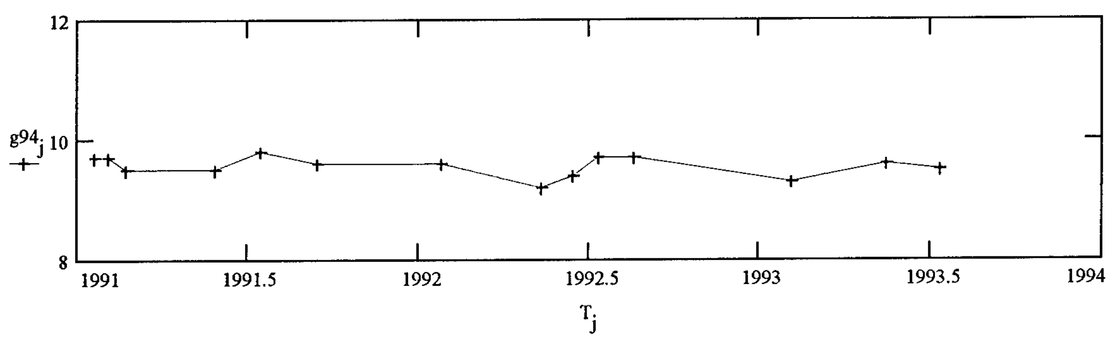
T
j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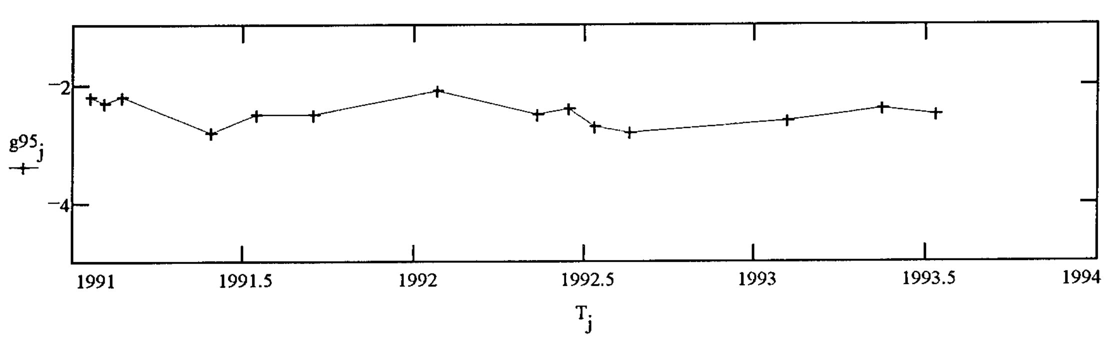
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T
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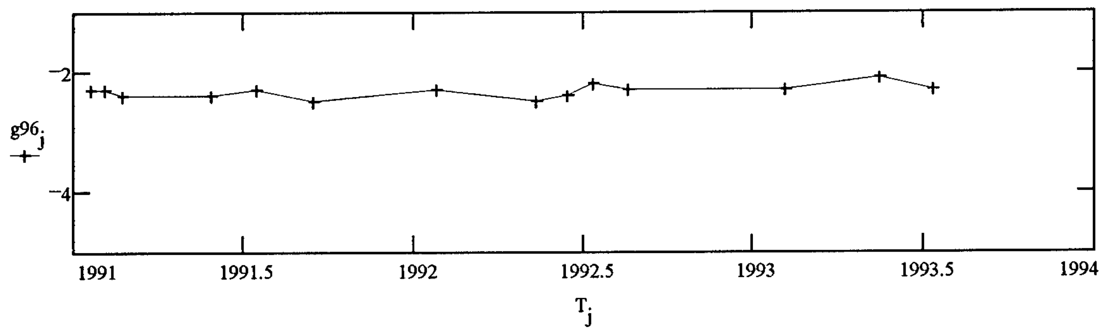
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g96$_j$
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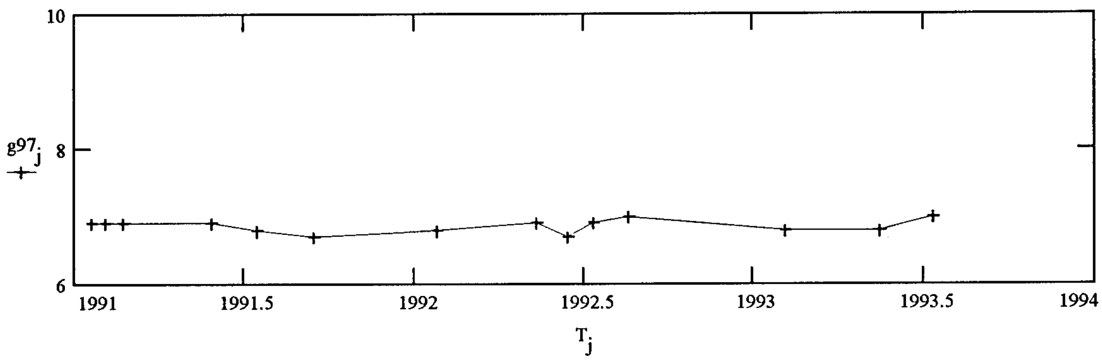
T$_j$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1992.5
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1993.5
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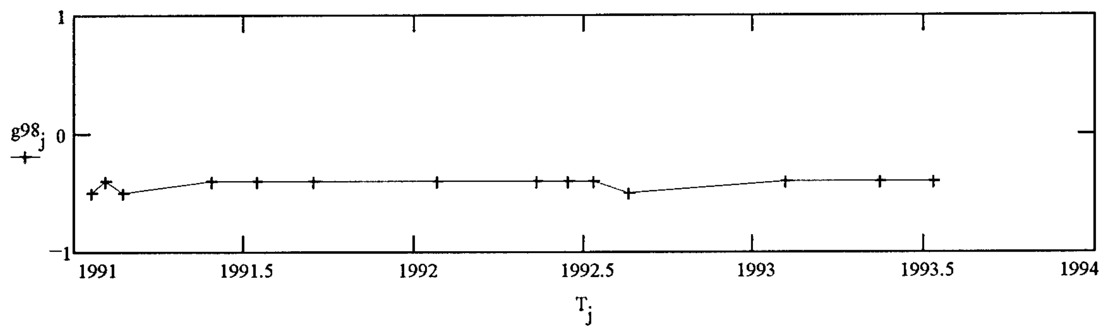
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1993.5
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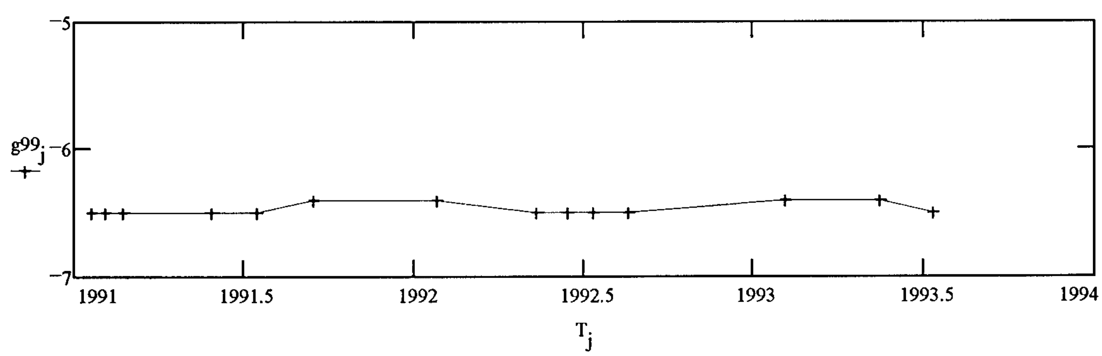
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g99$_j$
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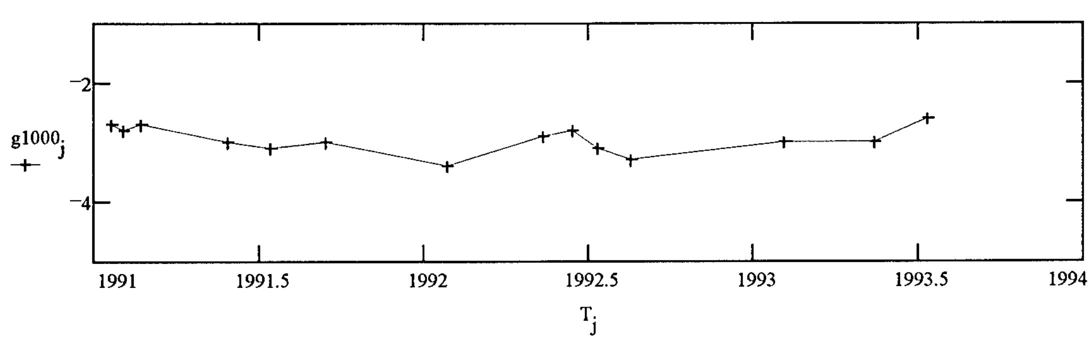
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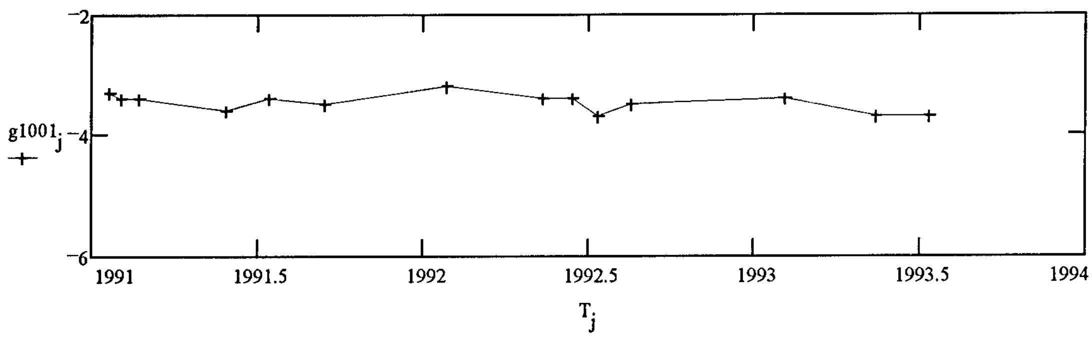

−2
g1001j −4
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1993.5
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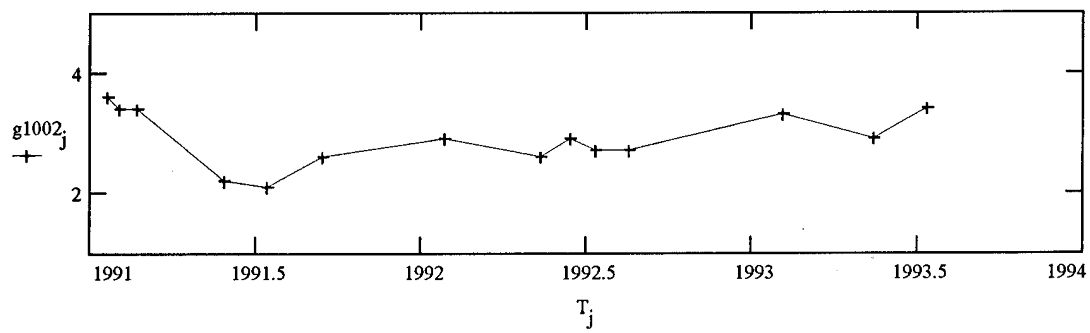

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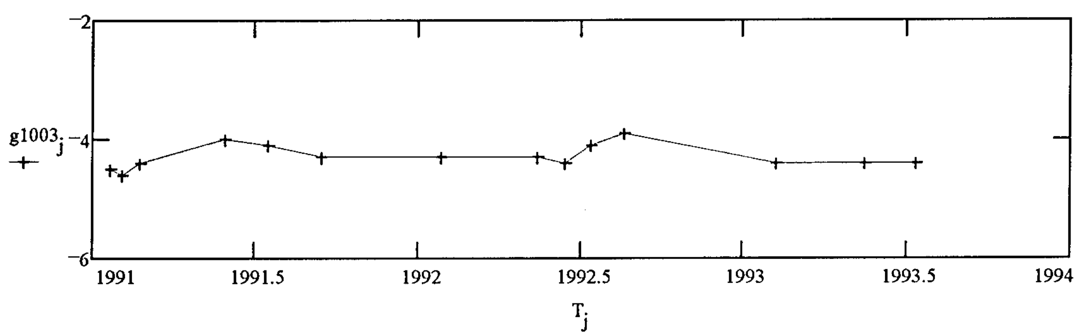

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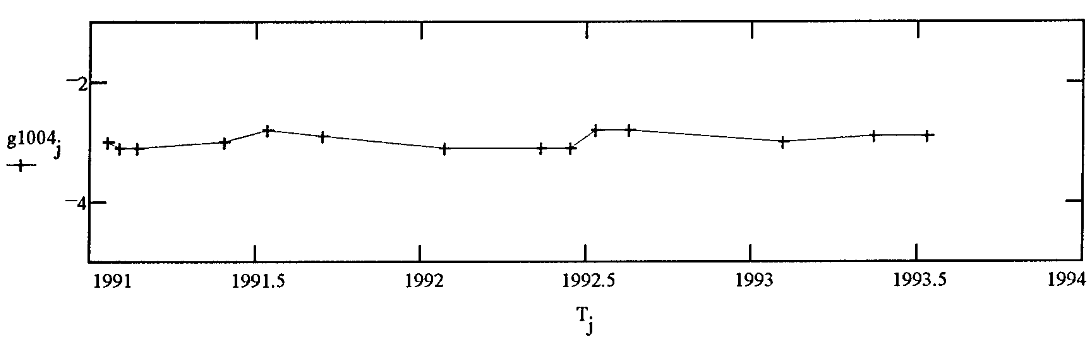

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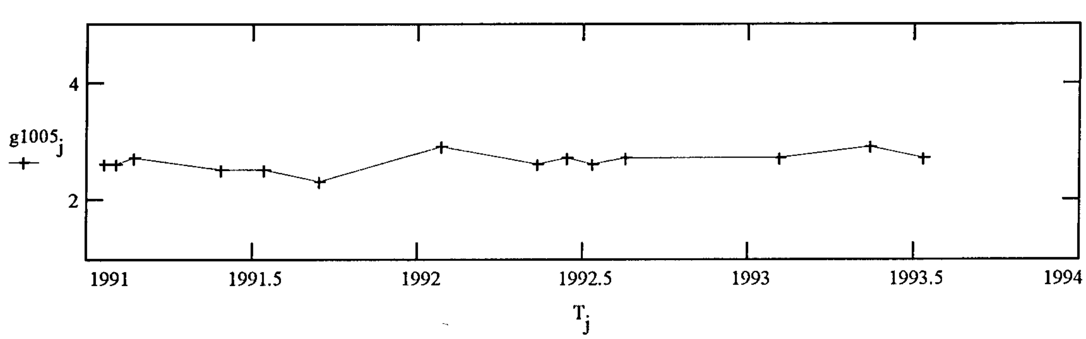

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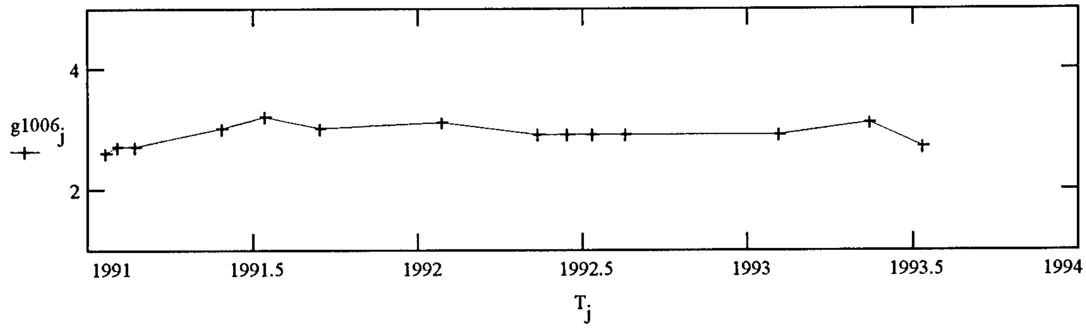

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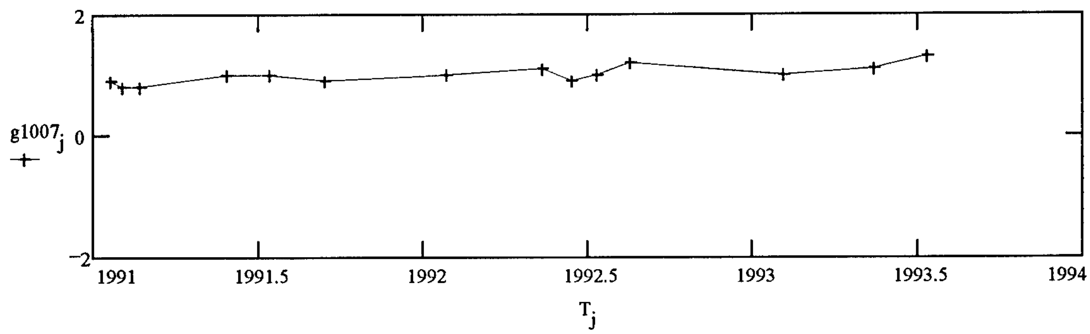

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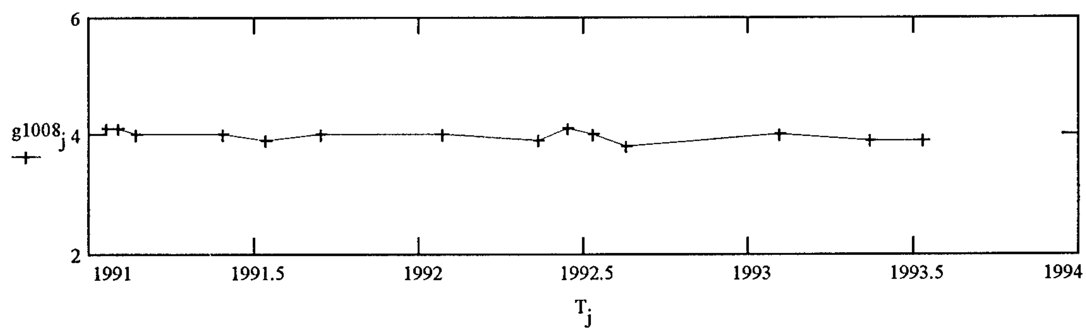

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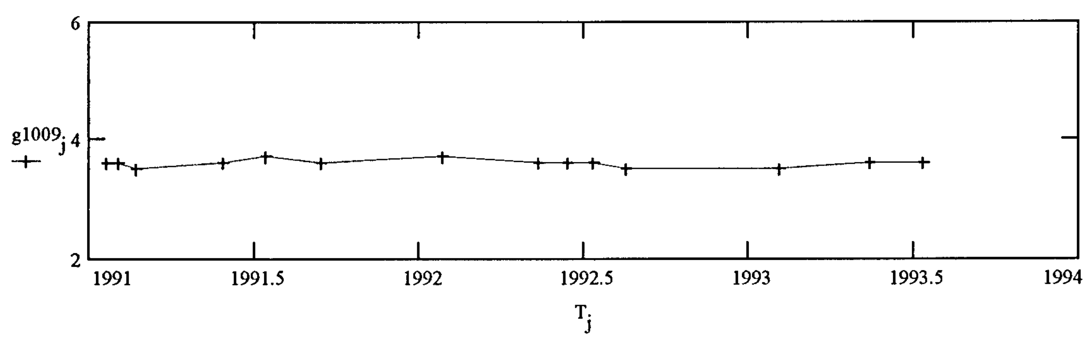

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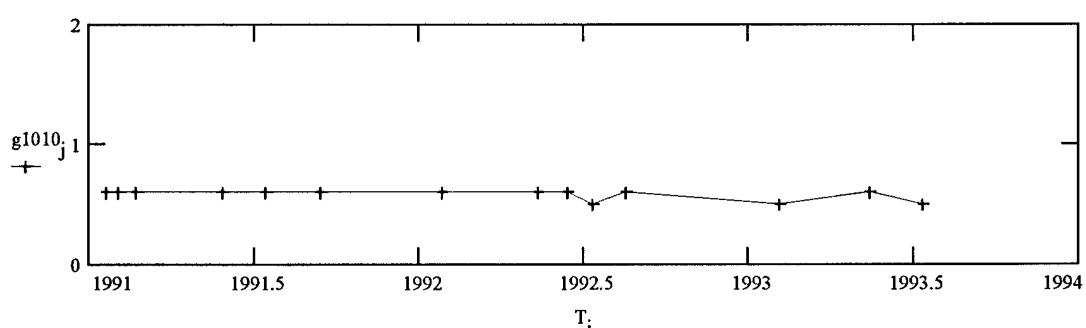

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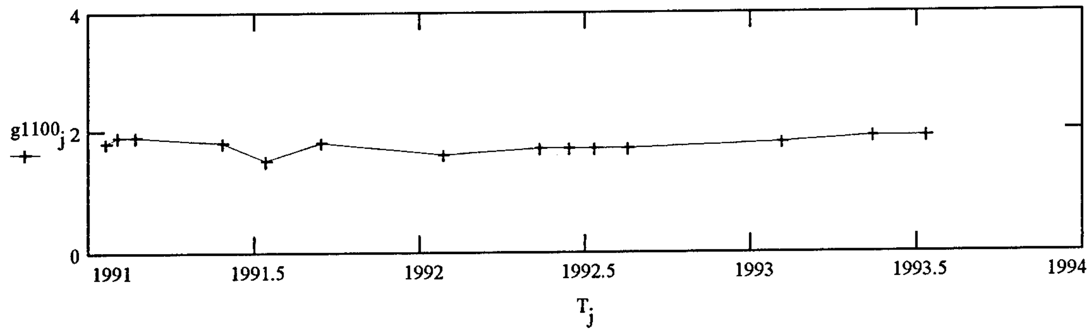
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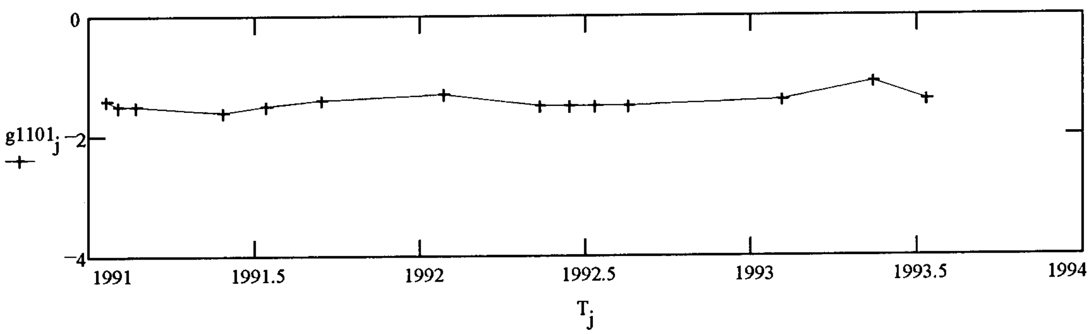
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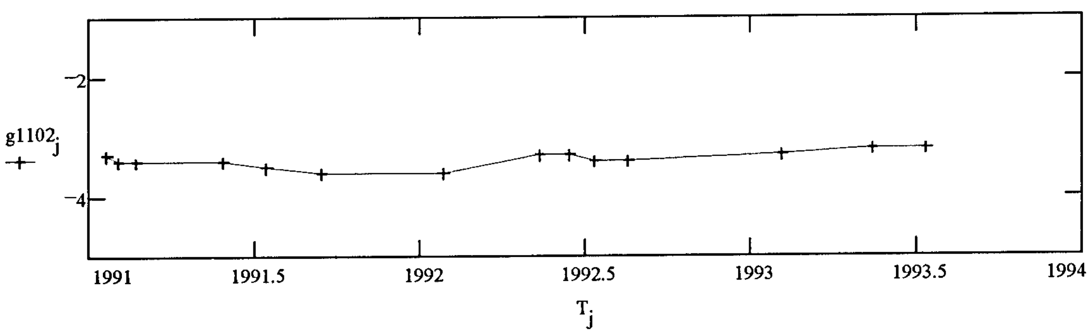
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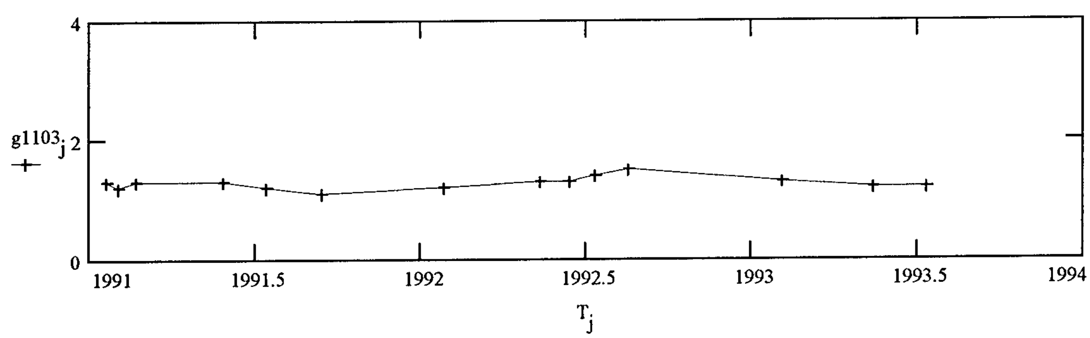
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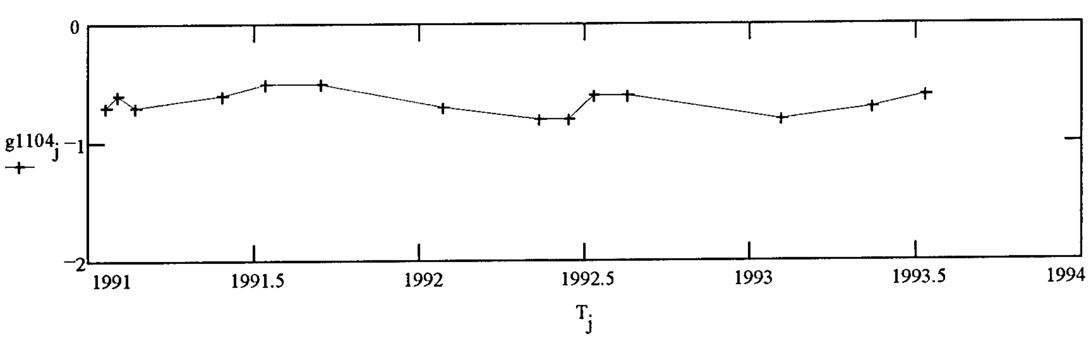
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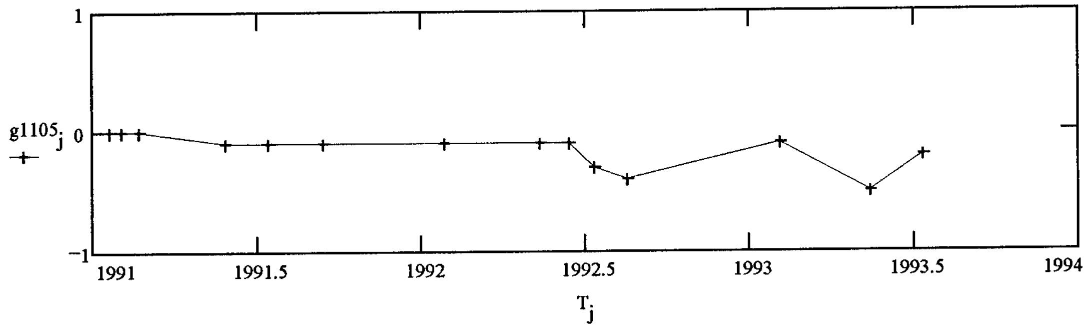
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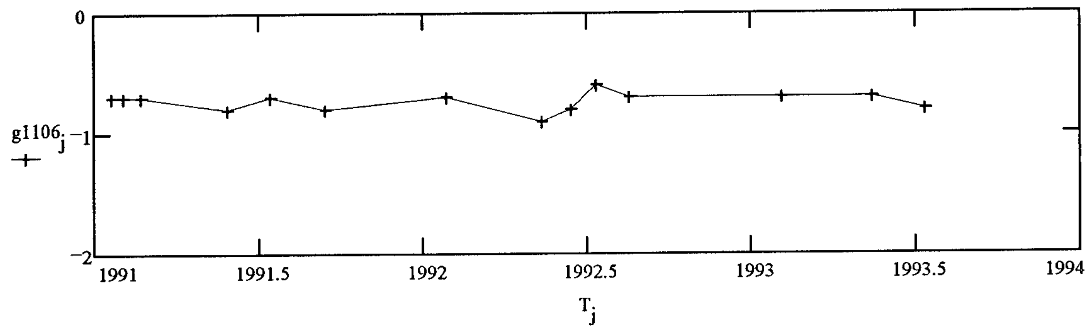
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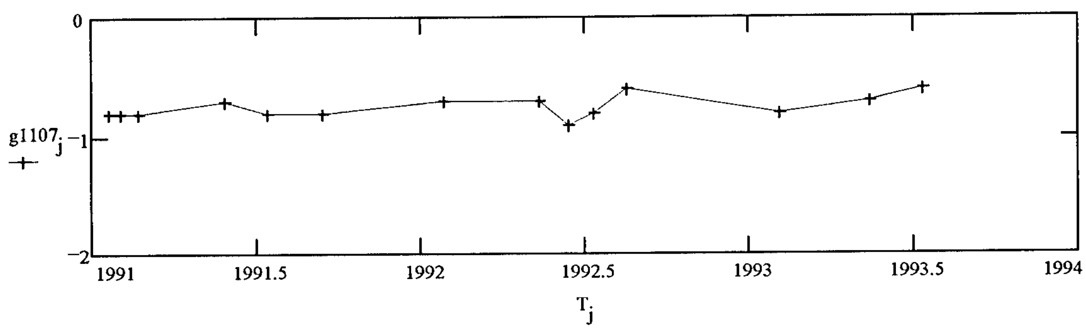
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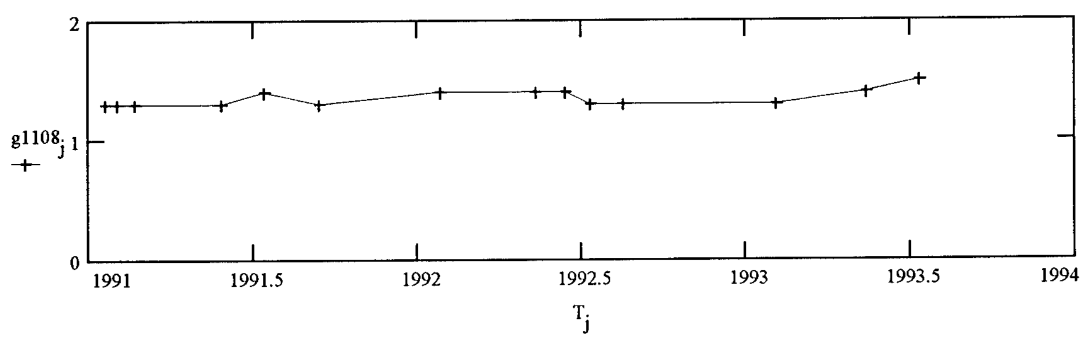
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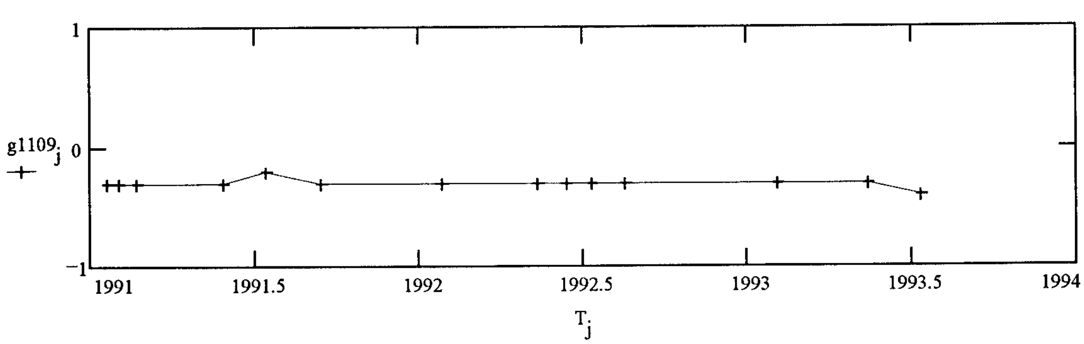
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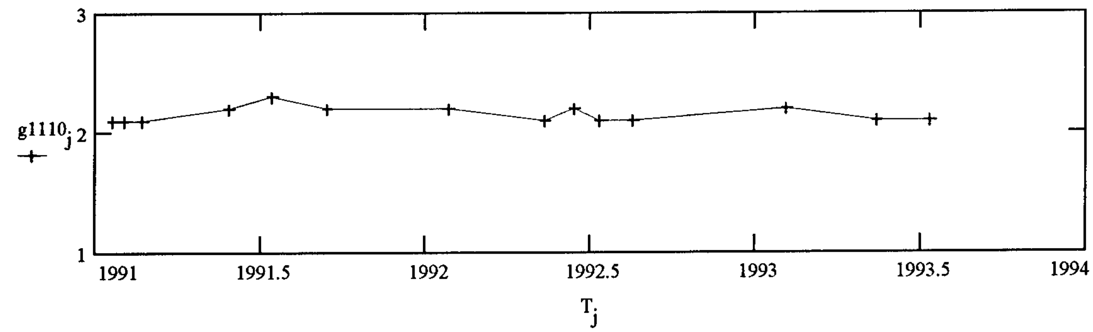
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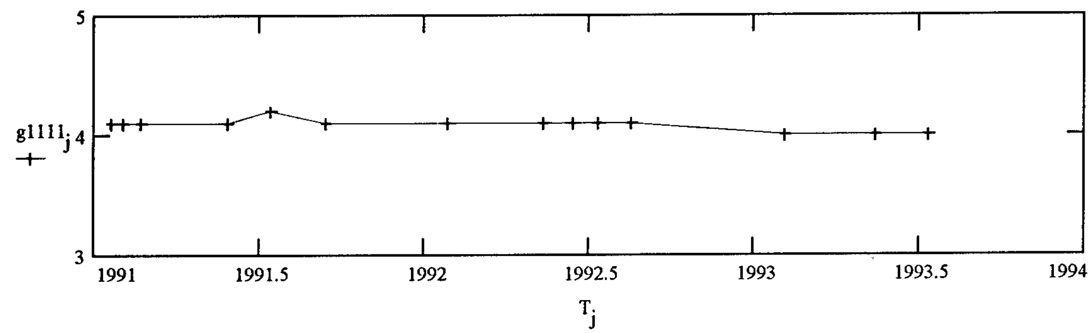
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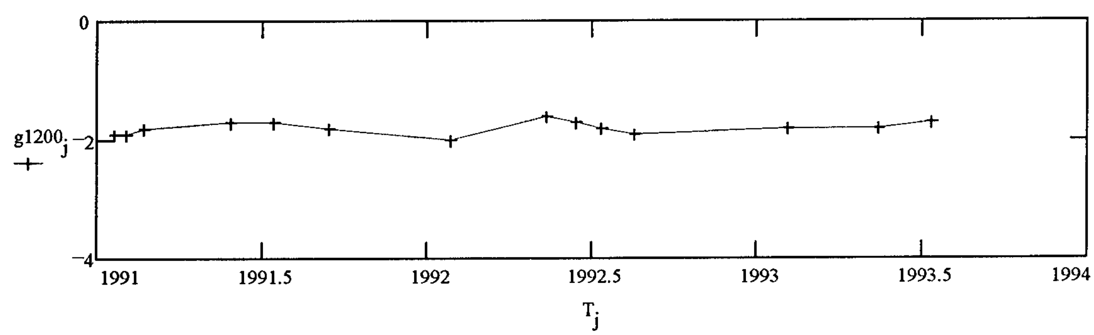
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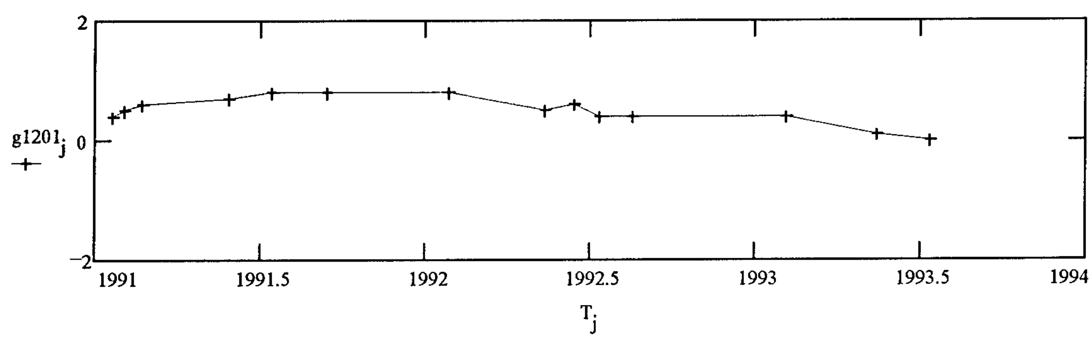
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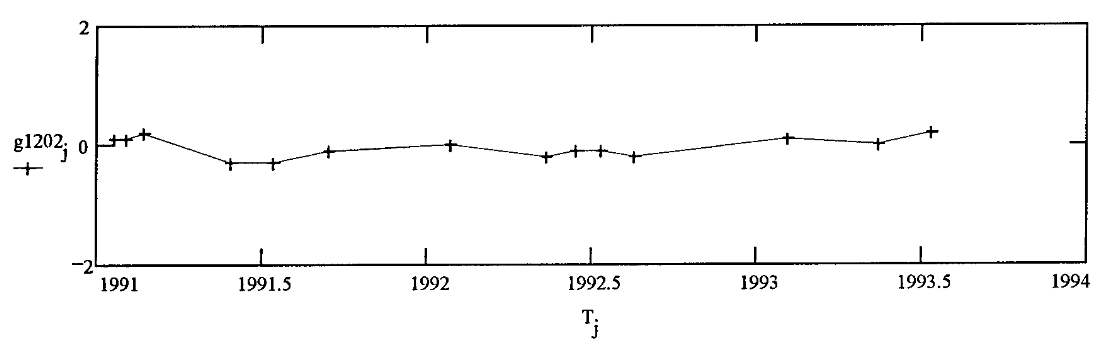
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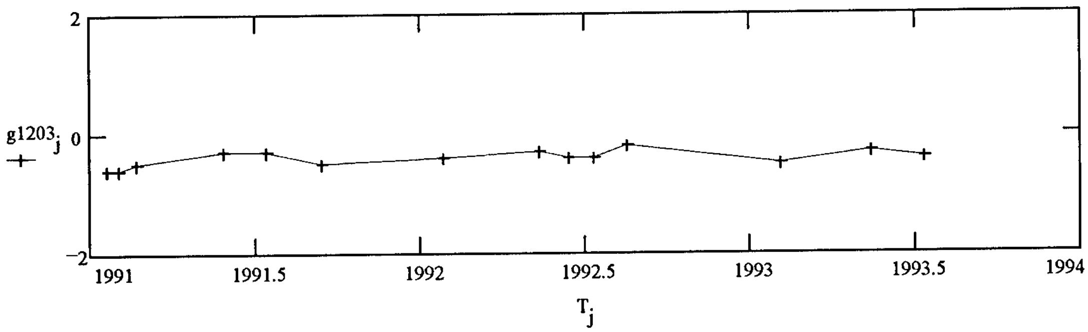
Tj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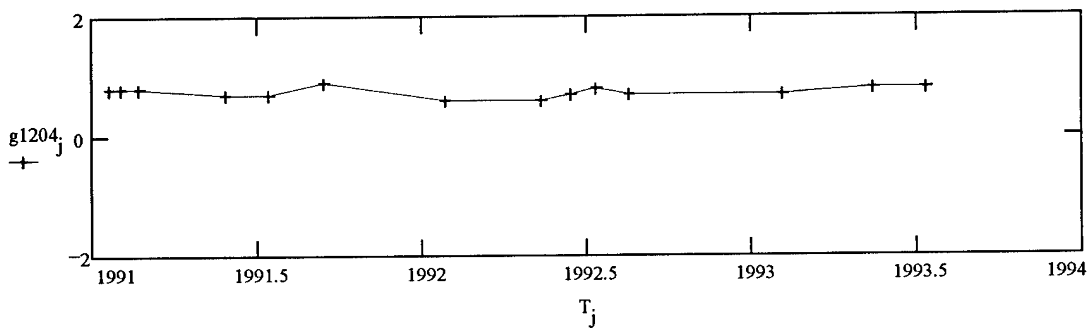
Tj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1993.5
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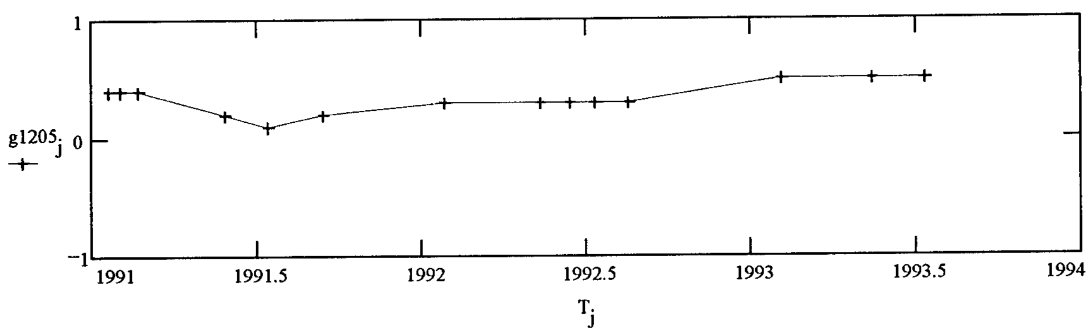
Tj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1993.5
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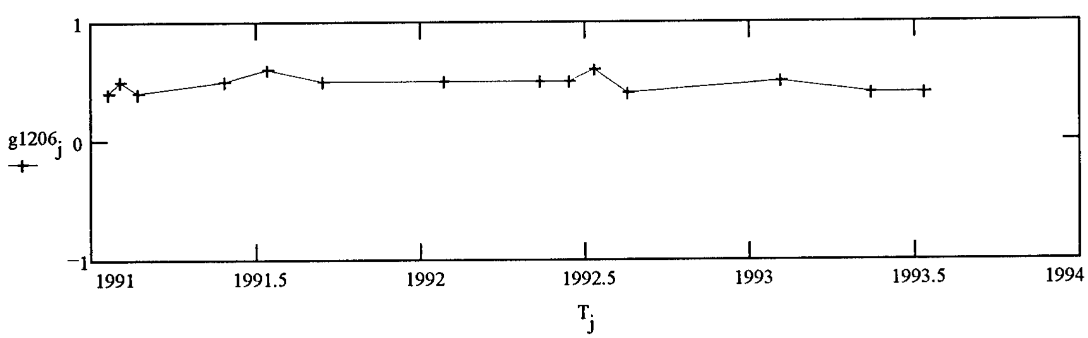
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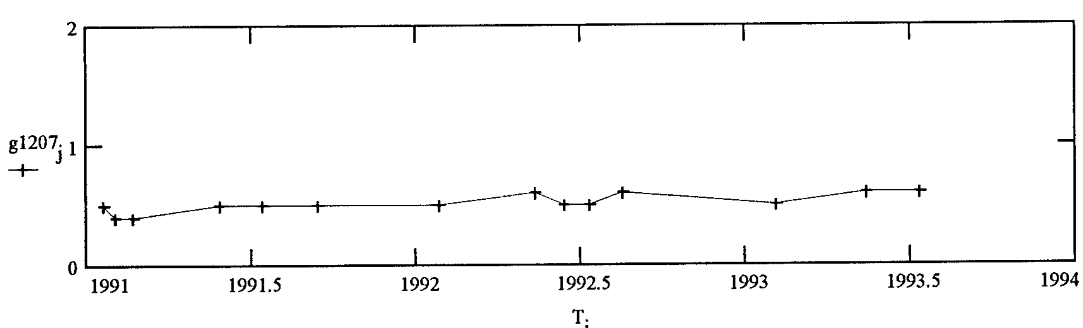
Tj


2
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0
g1207j
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1993.5
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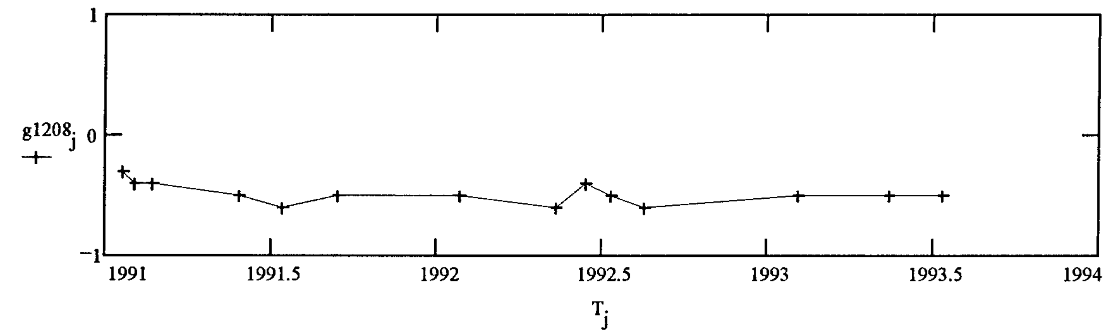
Tj



1
g1208$_j$ 0
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1992.5
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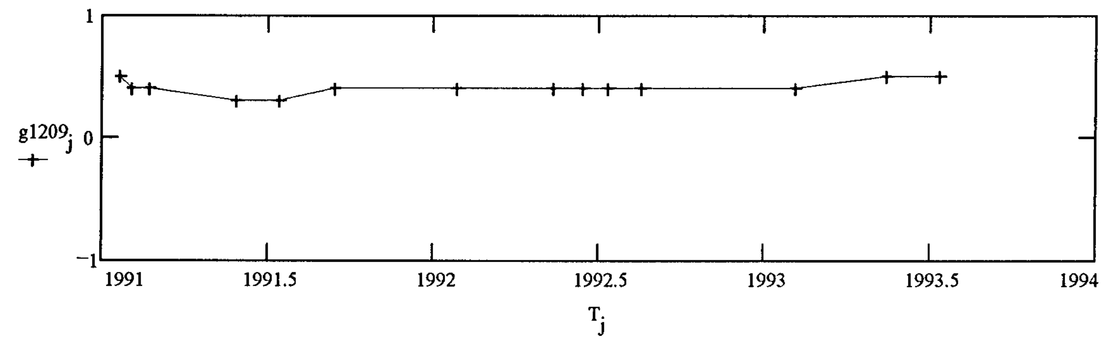

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1992.5
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1993.5
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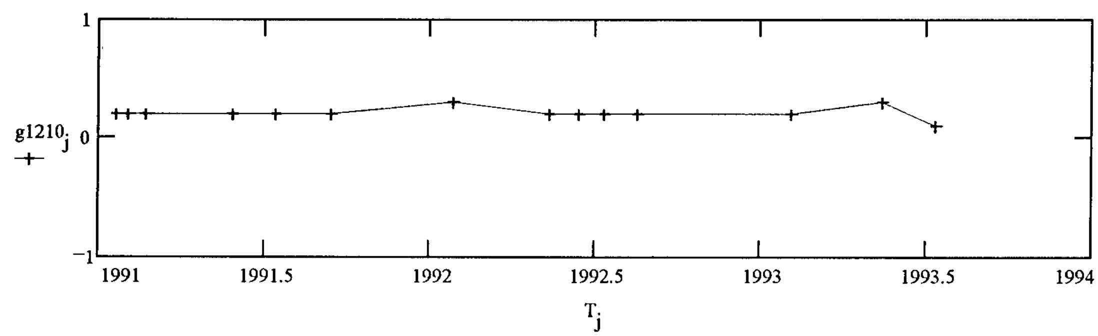
T_j



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g1210$_j$ 0
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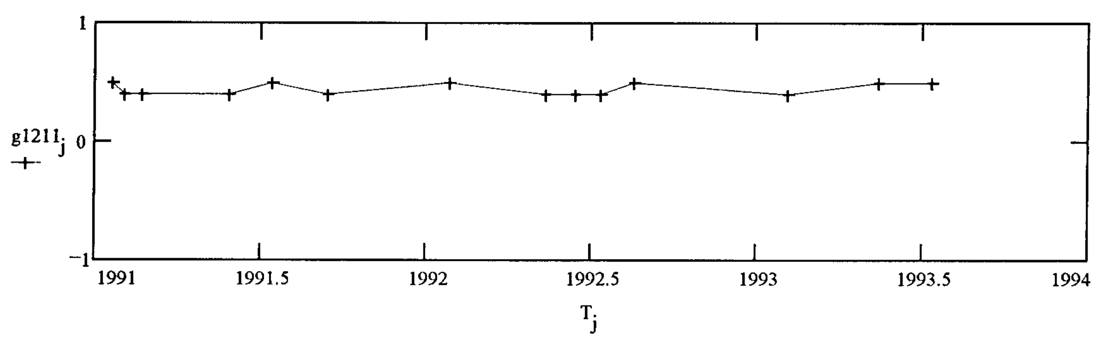
T_j



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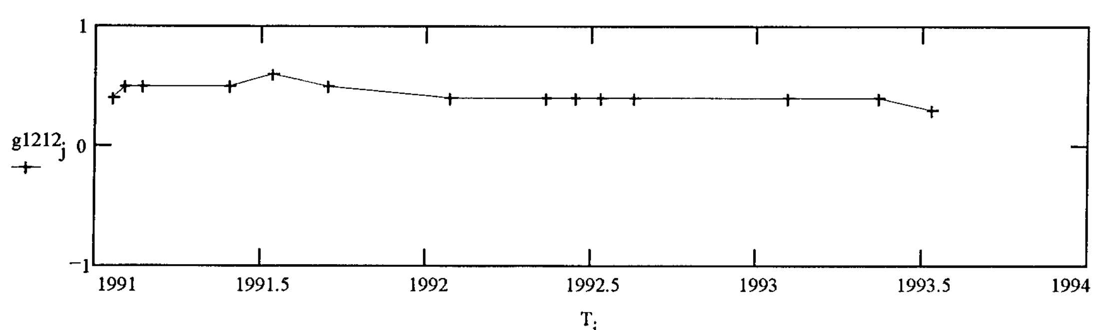
T_j



1
g1212$_j$ 0
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1991.5
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1992.5
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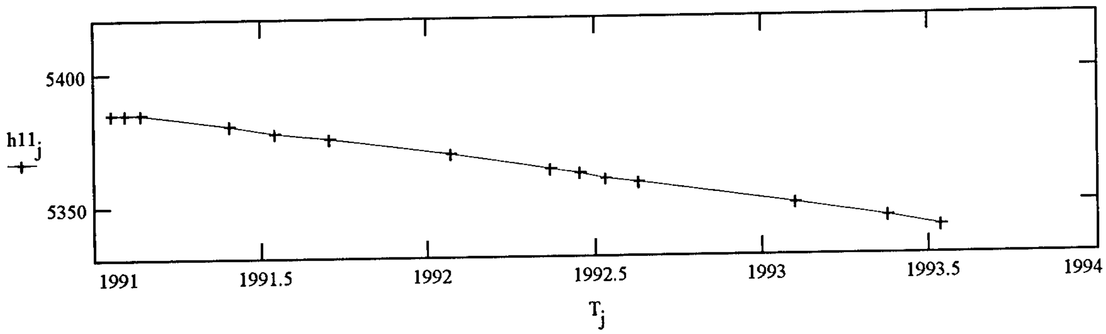
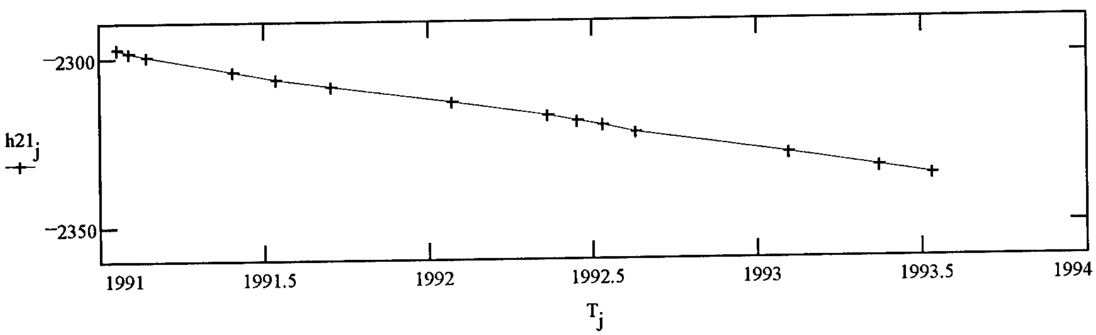
1993.5
1994
T_j

FIGURE 21.

GEOMAGNETIC SPHERICAL-HARMONIC COEFFICIENTS h_{nm} VERSUS TIME
(units: nT)

(Pages 207-224)


5400
5350
h11_j
1991
1991.5
1992
1992.5
1993
1993.5
1994
T_j


−2300
−2350
h21_j
1991
1991.5
1992
1992.5
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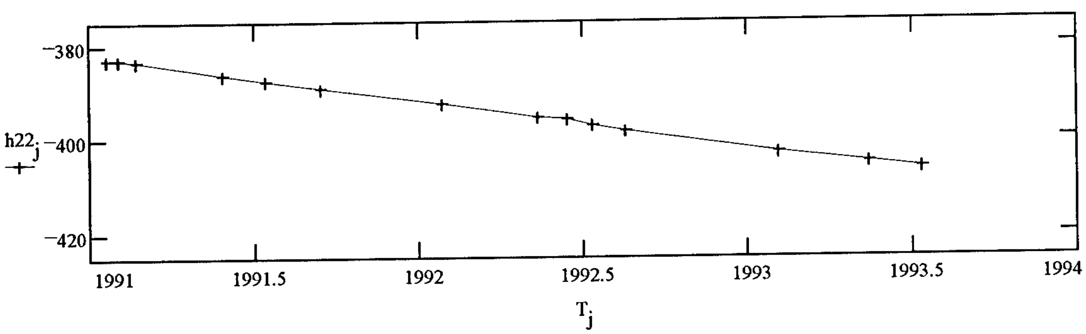
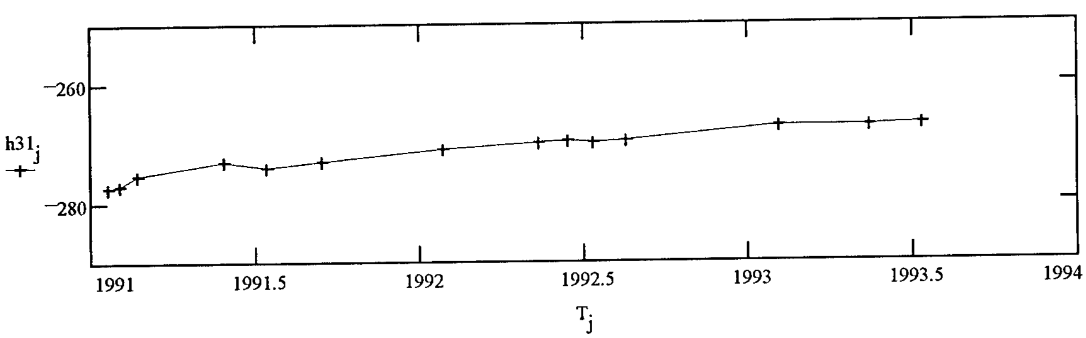
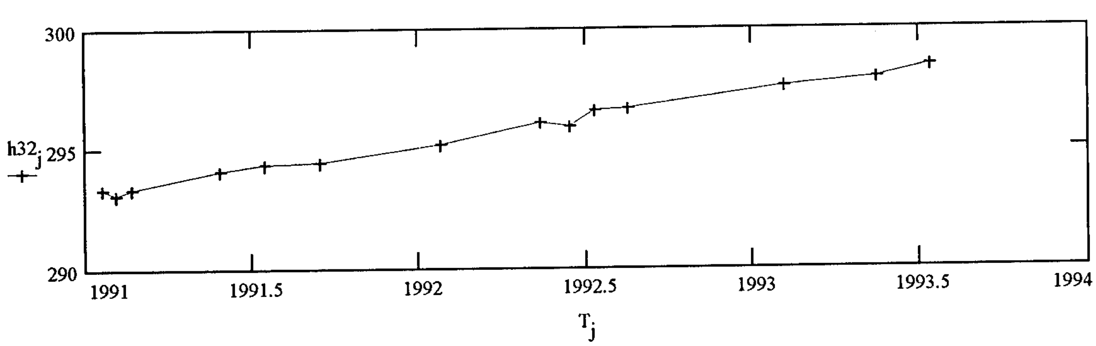
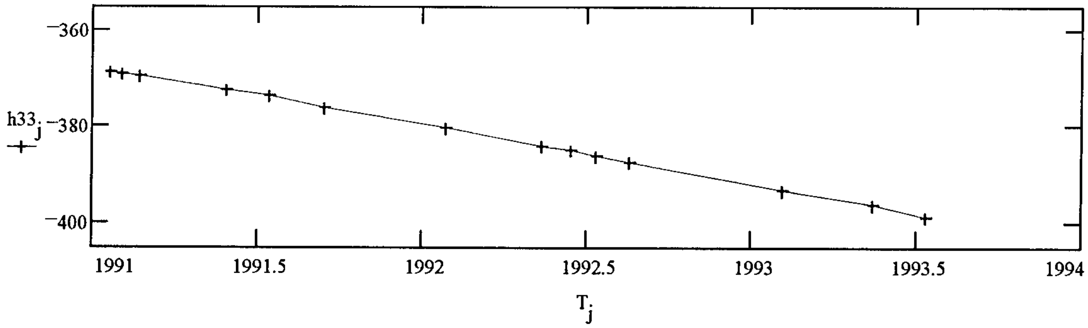
1993.5
1994
T_j

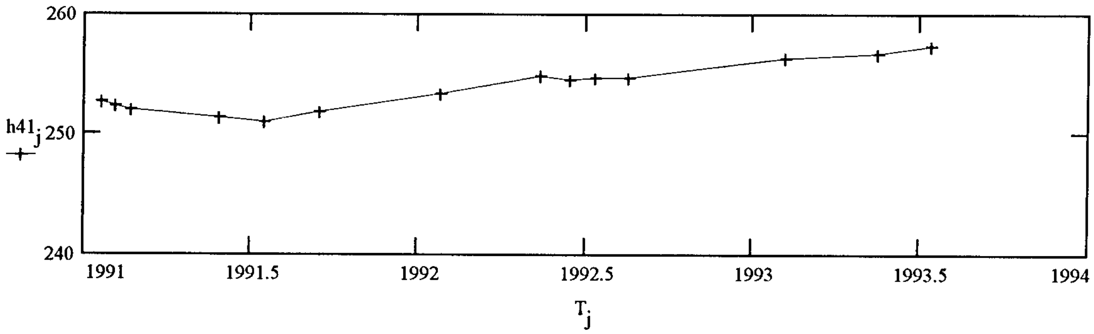

−380
−400
−420
h22_j
1991
1991.5
1992
1992.5
1993
1993.5
1994
T_j


−260
−280
h31_j
1991
1991.5
1992
1992.5
1993
1993.5
1994
T_j

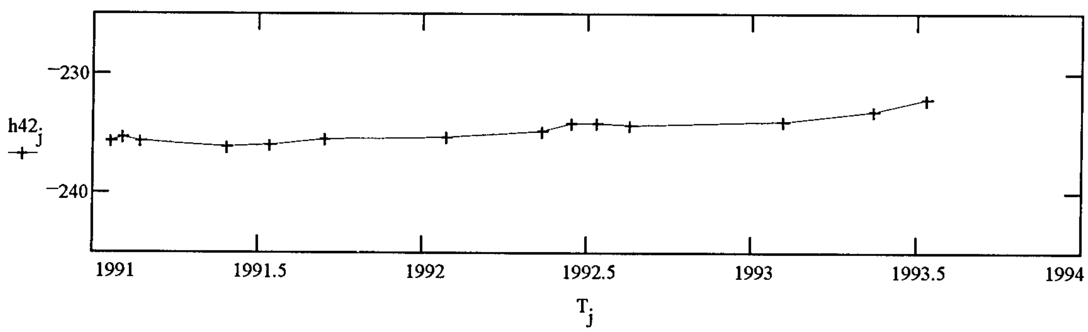

300
295
290
h32_j
1991
1991.5
1992
1992.5
1993
1993.5
1994
T_j



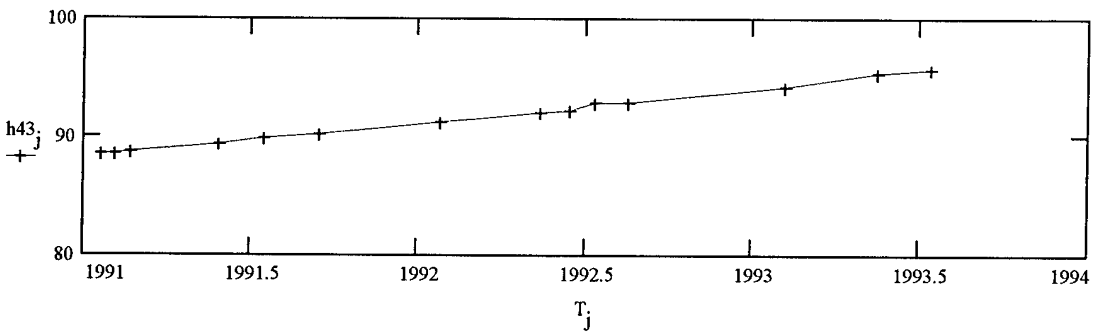
−360
−380
−400
h33j
1991
1991.5
1992
1992.5
1993
1993.5
1994
Tj



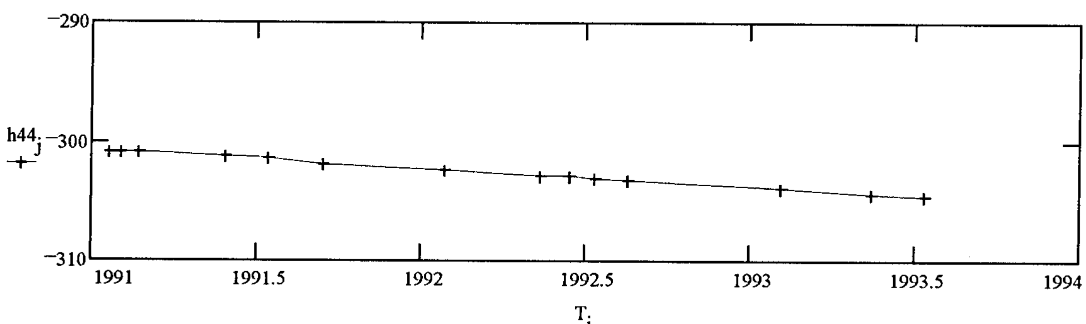
260
250
240
h41j
1991
1991.5
1992
1992.5
1993
1993.5
1994
Tj



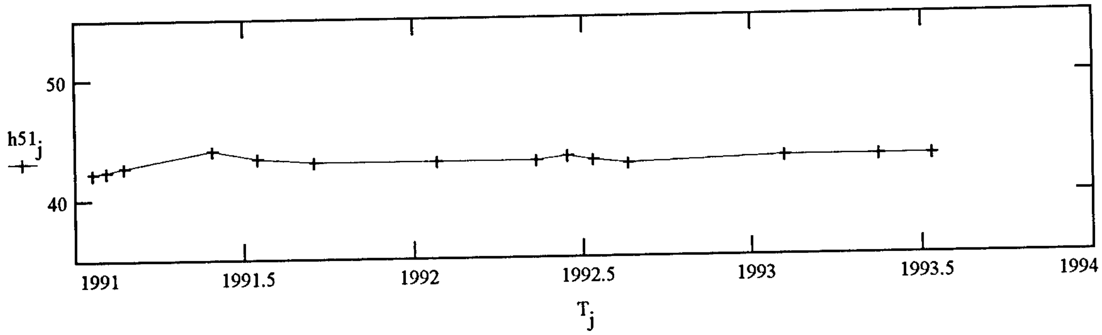
−230
−240
h42j
1991
1991.5
1992
1992.5
1993
1993.5
1994
Tj

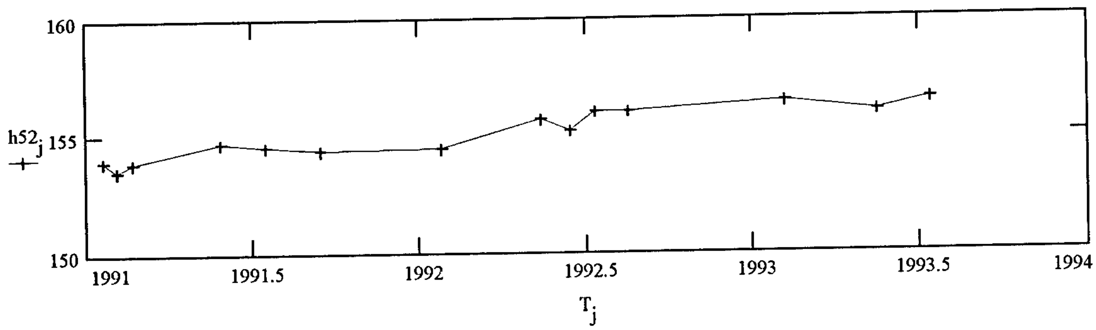


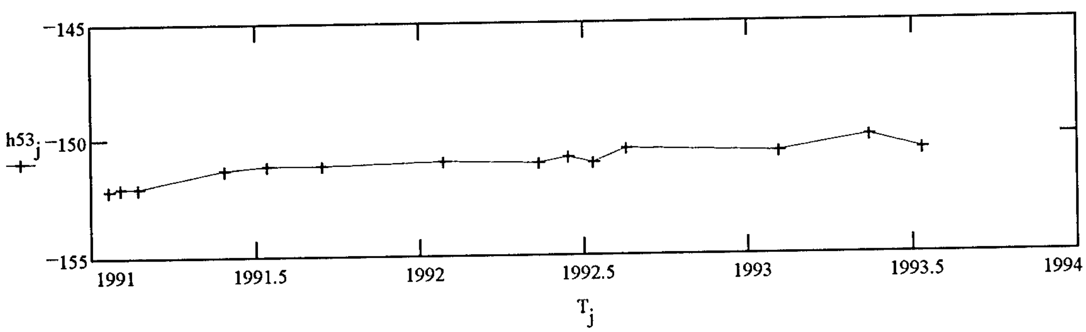
100
90
80
h43j
1991
1991.5
1992
1992.5
1993
1993.5
1994
Tj



−290
−300
−310
h44j
1991
1991.5
1992
1992.5
1993
1993.5
1994
Tj


50
h51j
40
1991
1991.5
1992
1992.5
1993
1993.5
1994
Tj


160
h52j 155
150
1991
1991.5
1992
1992.5
1993
1993.5
1994
Tj


−145
h53j −150
−155
1991
1991.5
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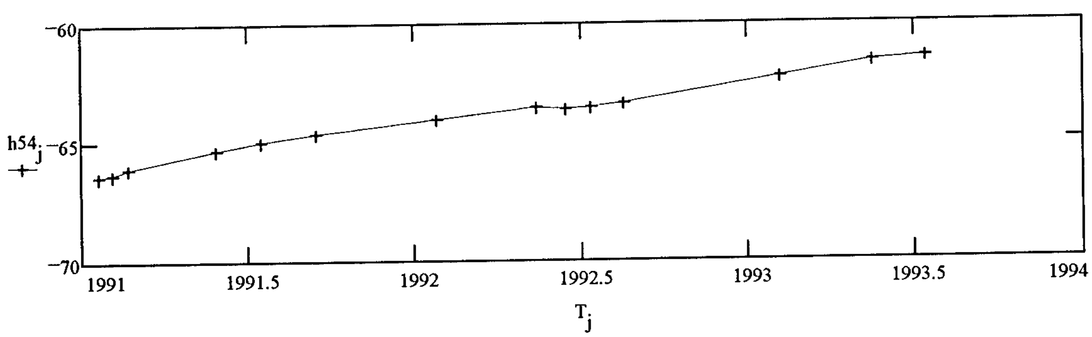
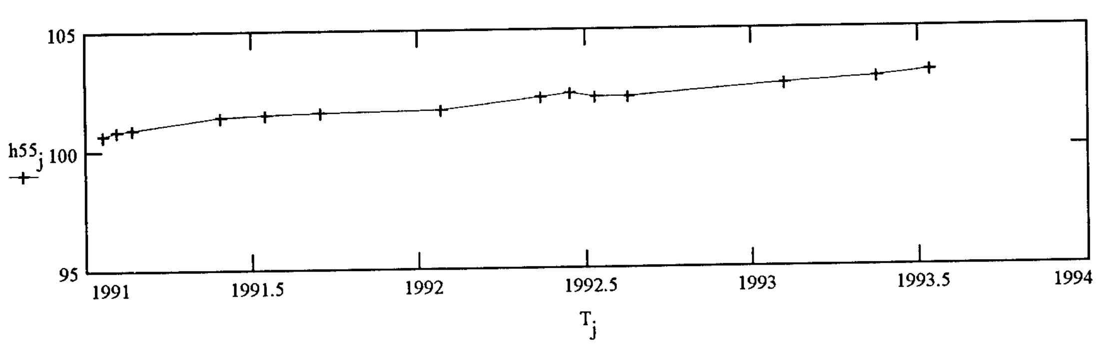
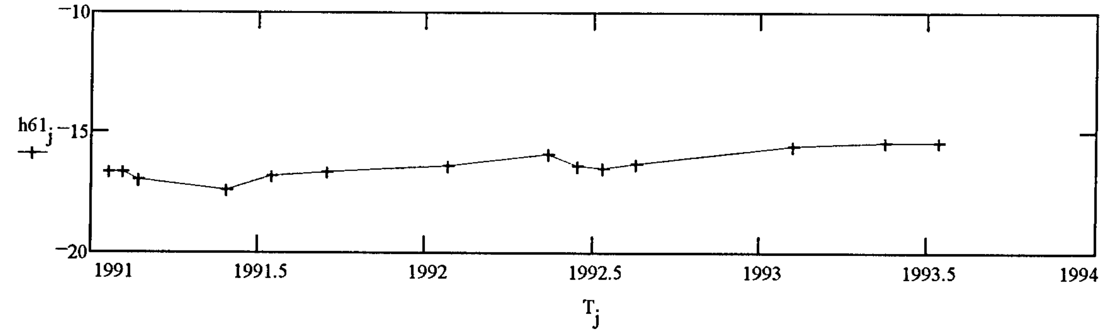
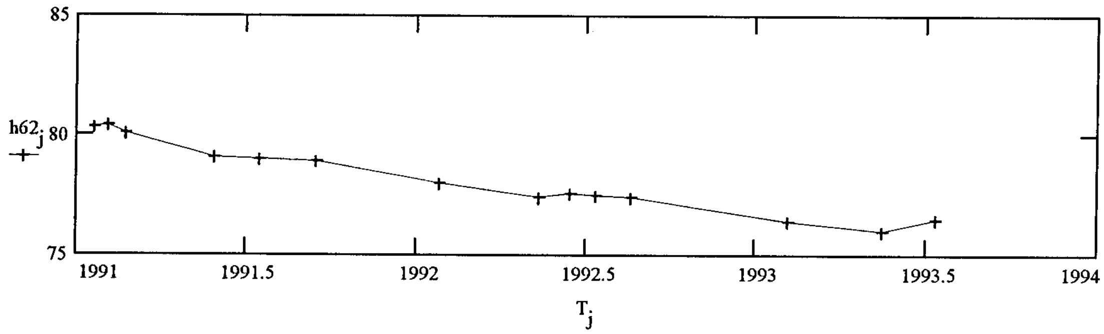
1993.5
1994
Tj


−60
h54j −65
−70
1991
1991.5
1992
1992.5
1993
1993.5
1994
Tj


105
h55j 100
95
1991
1991.5
1992
1992.5
1993
1993.5
1994
Tj



−10
h61$_j$ −15
−20
1991
1991.5
1992
1992.5
1993
1993.5
1994
T$_j$



85
h62$_j$ 80
75
1991
1991.5
1992
1992.5
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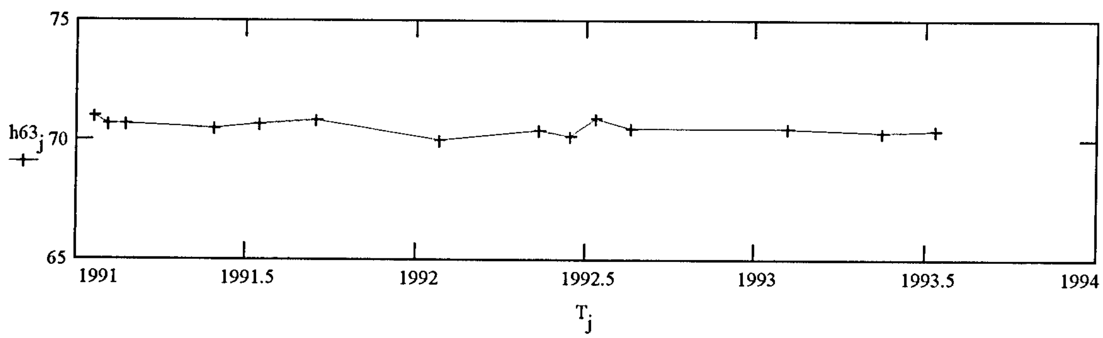
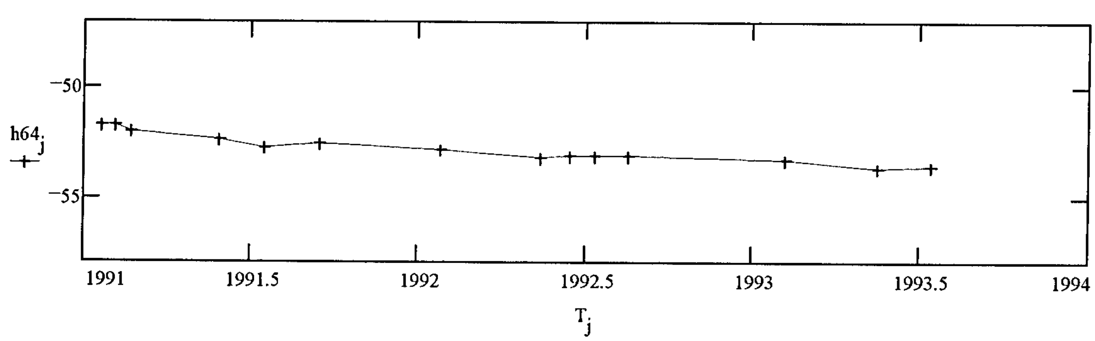
1993.5
1994
T$_j$



75
h63$_j$ 70
65
1991
1991.5
1992
1992.5
1993
1993.5
1994
T$_j$



−50
h64$_j$
−55
1991
1991.5
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1992.5
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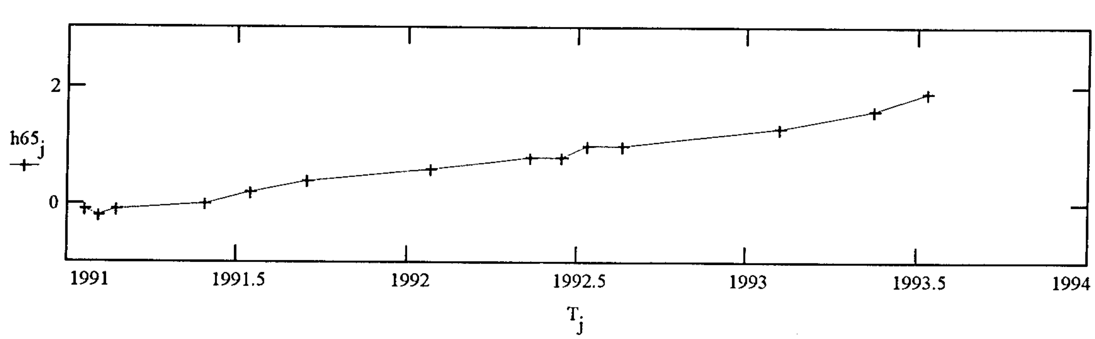
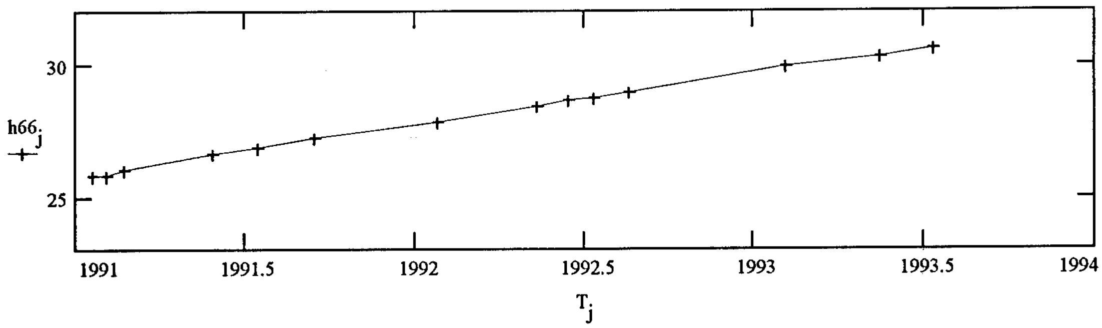
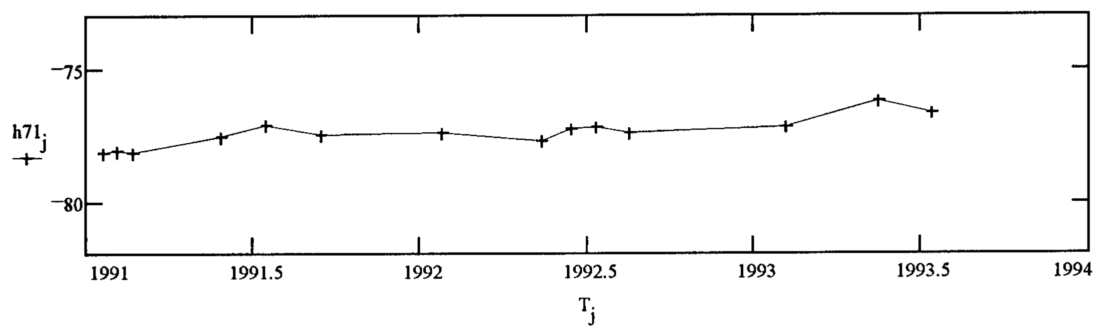
1993.5
1994
T$_j$



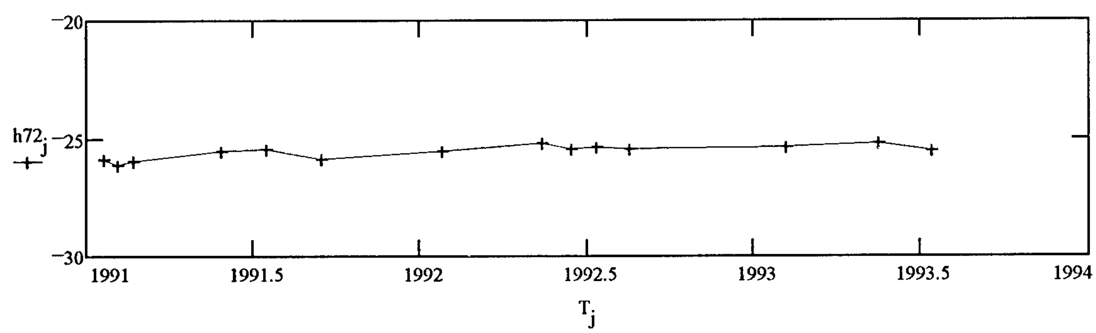
2
h65$_j$
0
1991
1991.5
1992
1992.5
1993
1993.5
1994
T$_j$



30
25
h66j
1991
1991.5
1992
1992.5
1993
1993.5
1994
Tj



−75
−80
h71j
1991
1991.5
1992
1992.5
1993
1993.5
1994
Tj



−20
−25
−30
h72j
1991
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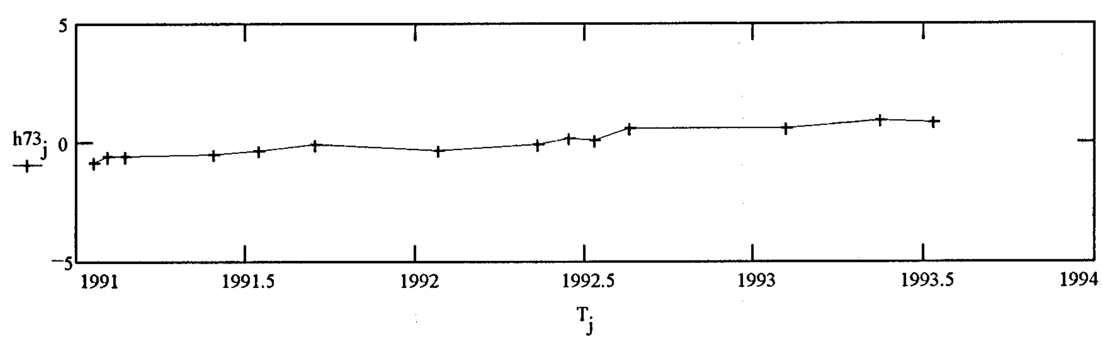
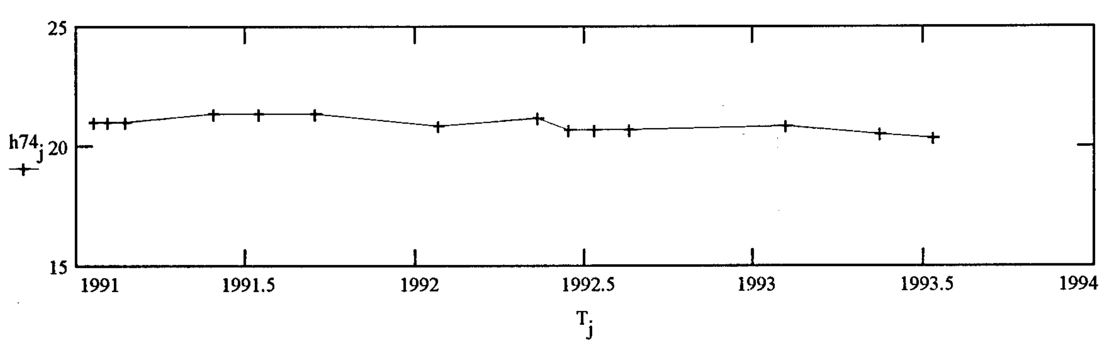
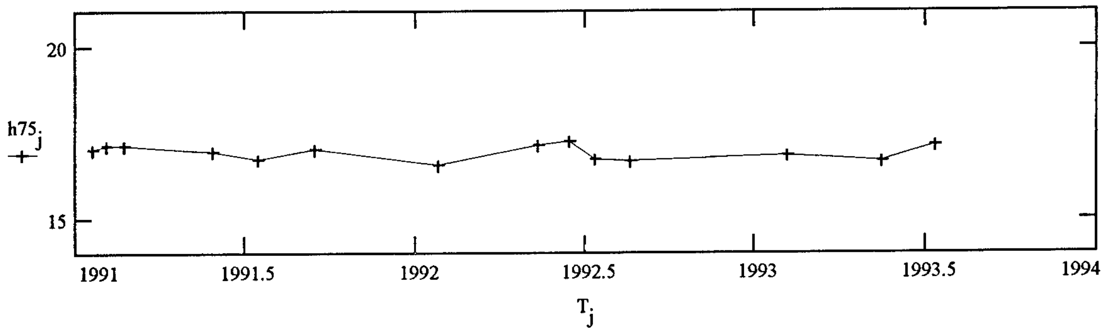
1992
1992.5
1993
1993.5
1994
Tj



5
0
−5
h73j
1991
1991.5
1992
1992.5
1993
1993.5
1994
Tj



25
20
15
h74j
1991
1991.5
1992
1992.5
1993
1993.5
1994
Tj


20
15
h75j
1991
1991.5
1992
1992.5
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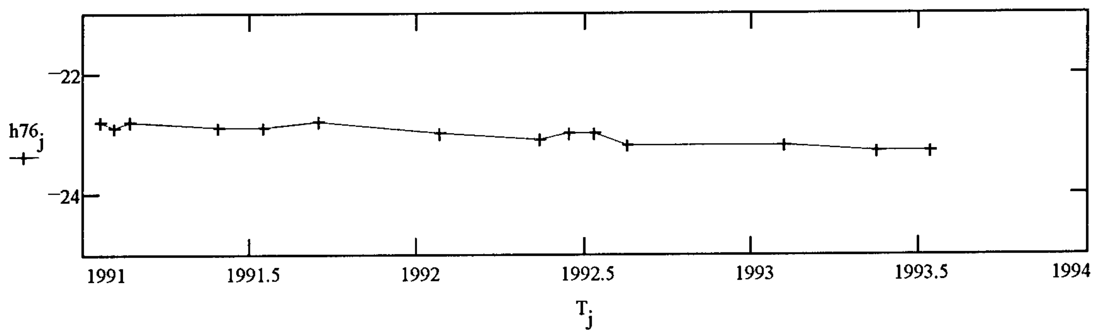
1993.5
1994
Tj


−22
−24
h76j
1991
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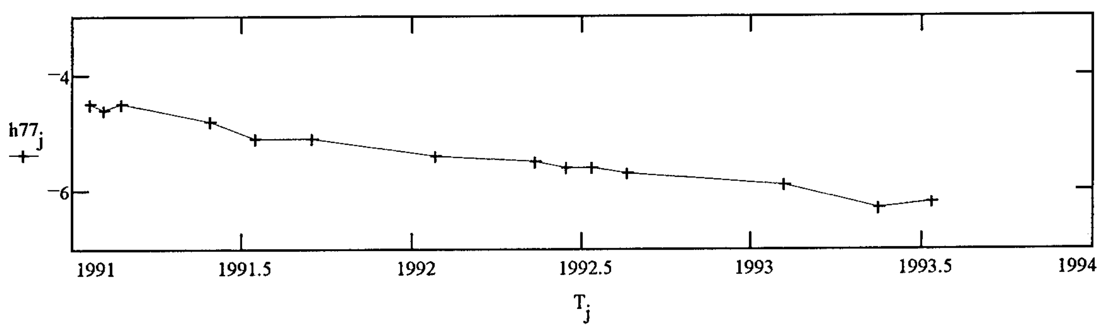
1992
1992.5
1993
1993.5
1994
Tj


−4
−6
h77j
1991
1991.5
1992
1992.5
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1993.5
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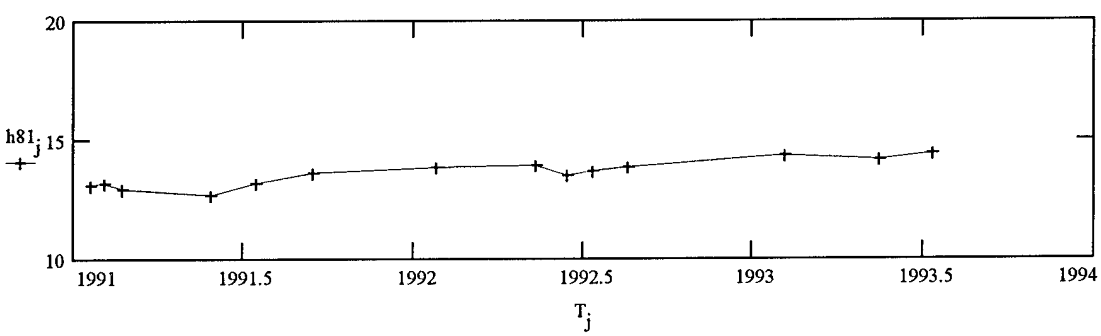
Tj


20
15
10
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1991
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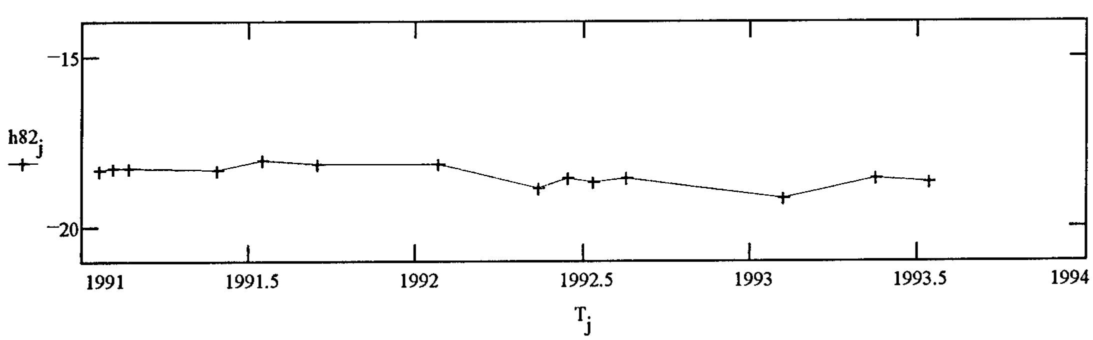
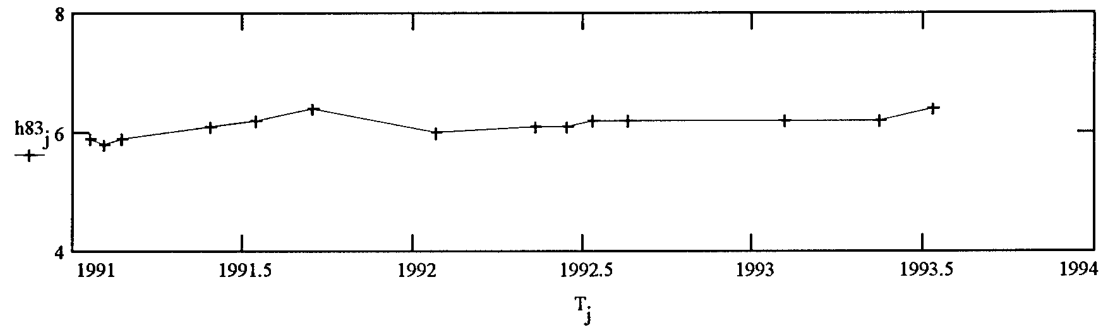
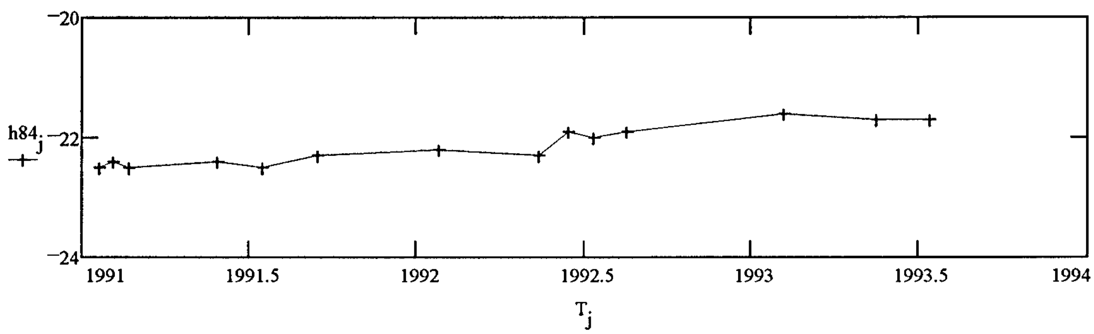
1992
1992.5
1993
1993.5
1994
Tj


−15
−20
h82j
1991
1991.5
1992
1992.5
1993
1993.5
1994
Tj



8
6
4
h83
j
1991
1991.5
1992
1992.5
1993
1993.5
1994
T
j



−20
−22
−24
h84
j
1991
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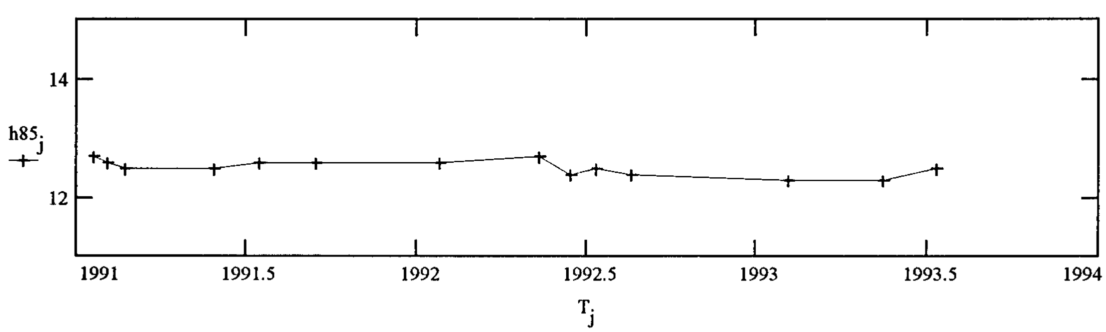
1993
1993.5
1994
T
j



14
12
h85
j
1991
1991.5
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1992.5
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1993.5
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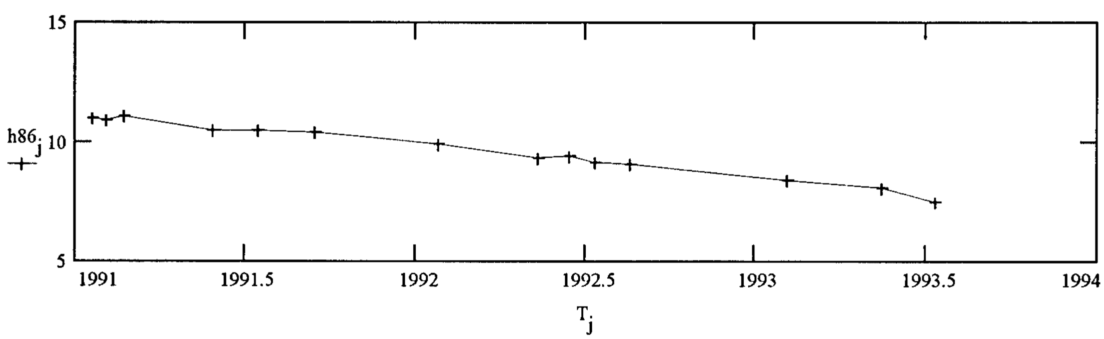
T
j



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10
5
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1993.5
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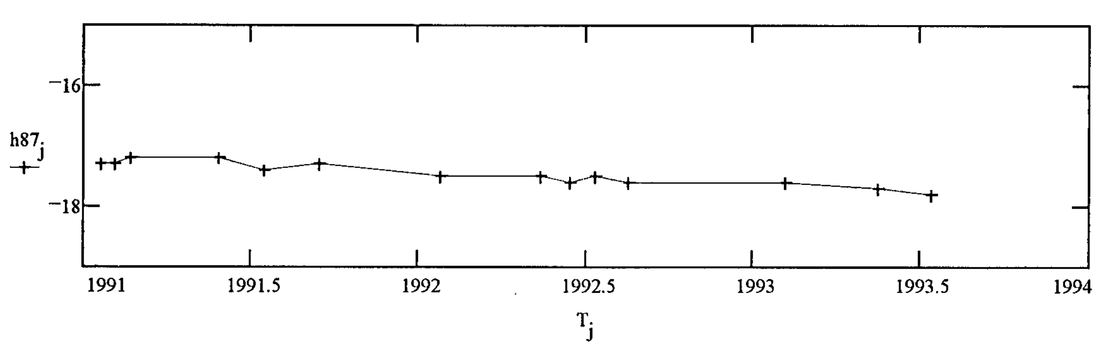
T
j



−16
−18
h87
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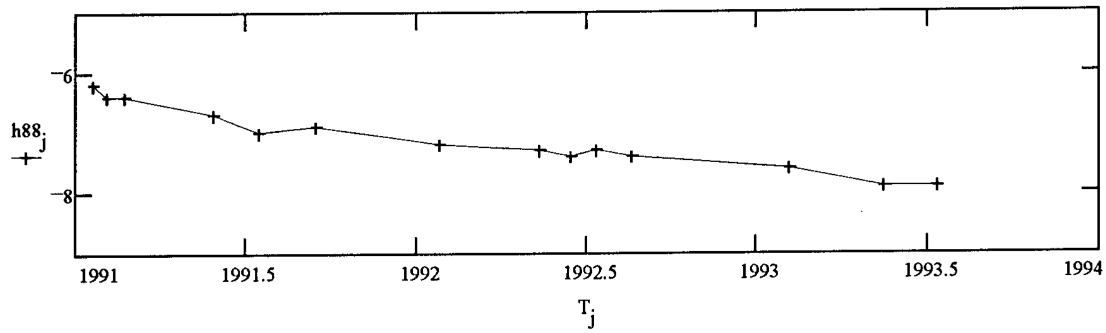
T
j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1993.5
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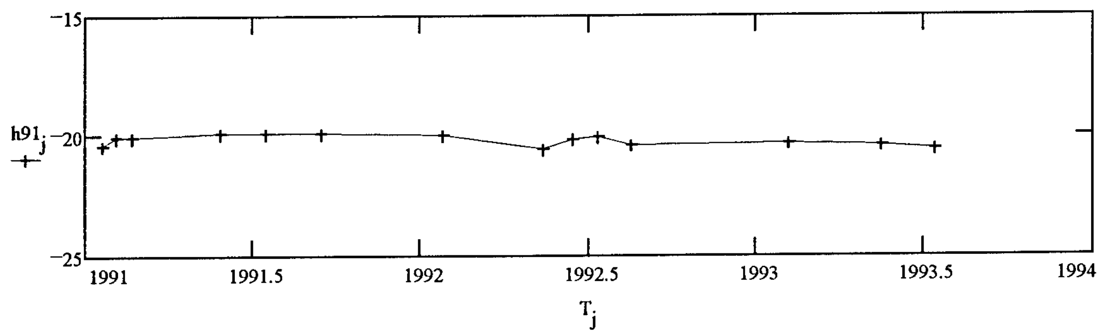
T_j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−20
−25
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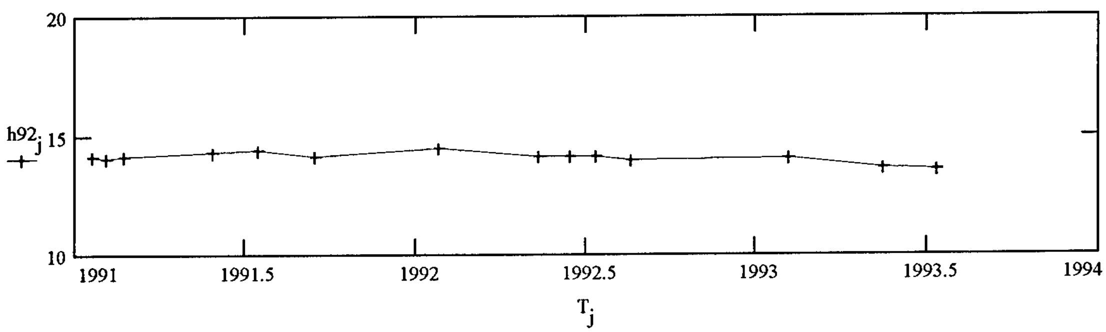
1992
1992.5
1993
1993.5
1994
T_j


h92_j
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10
1991
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1993
1993.5
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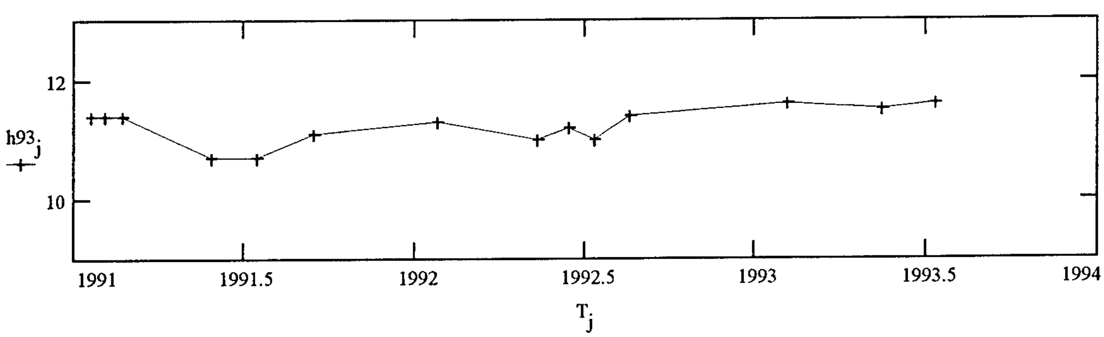
T_j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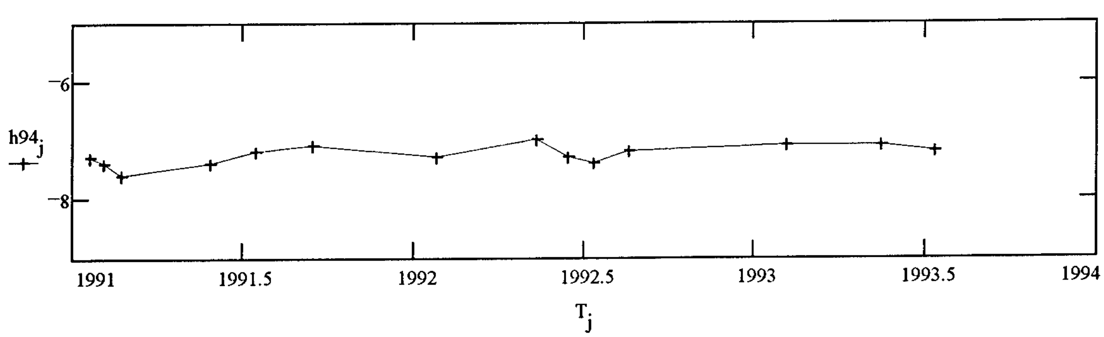
T_j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1993.5
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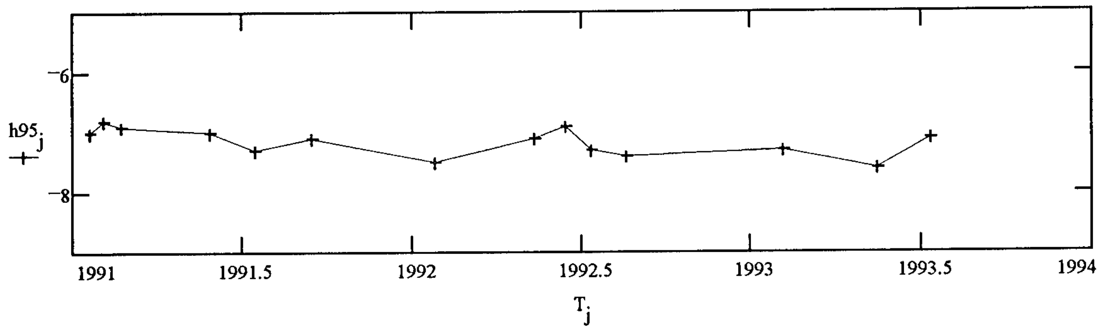
T_j


-6
-8
h95_j
1991
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1992
1992.5
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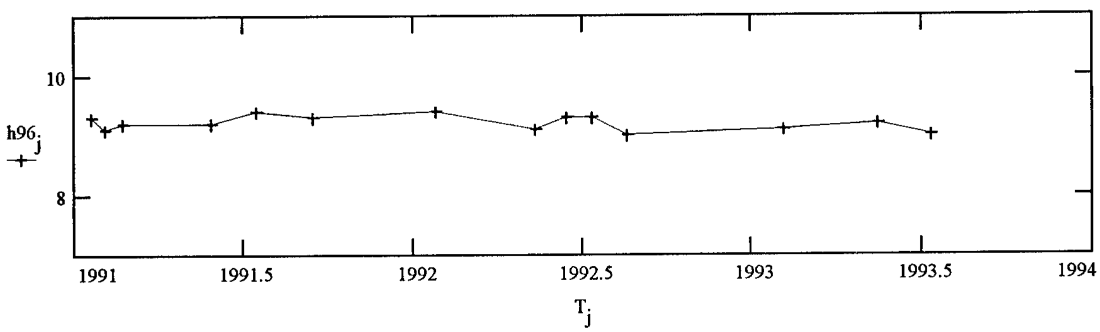
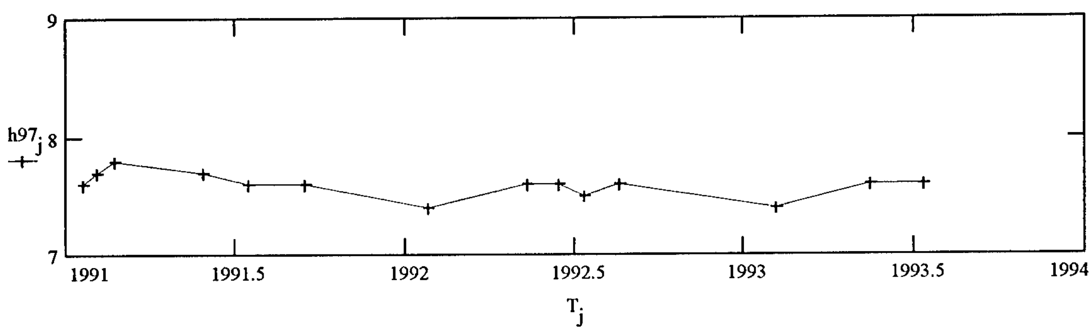
1993.5
1994
T_j


10
8
h96_j
1991
1991.5
1992
1992.5
1993
1993.5
1994
T_j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h97_j
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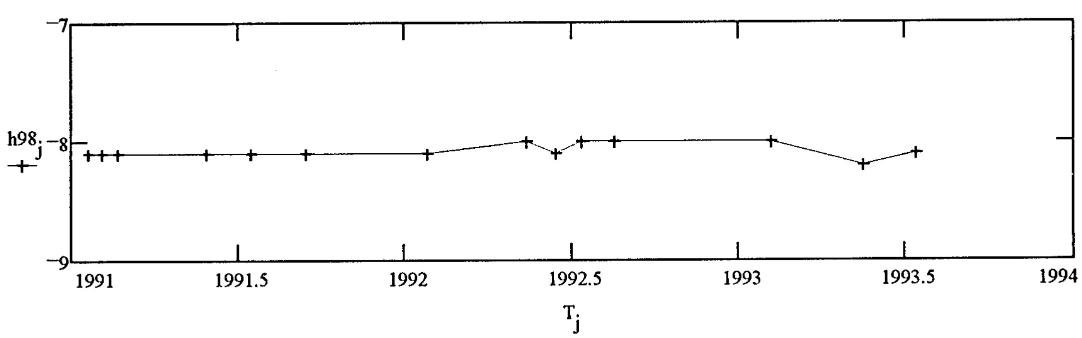
1992
1992.5
1993
1993.5
1994
T_j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h98_j
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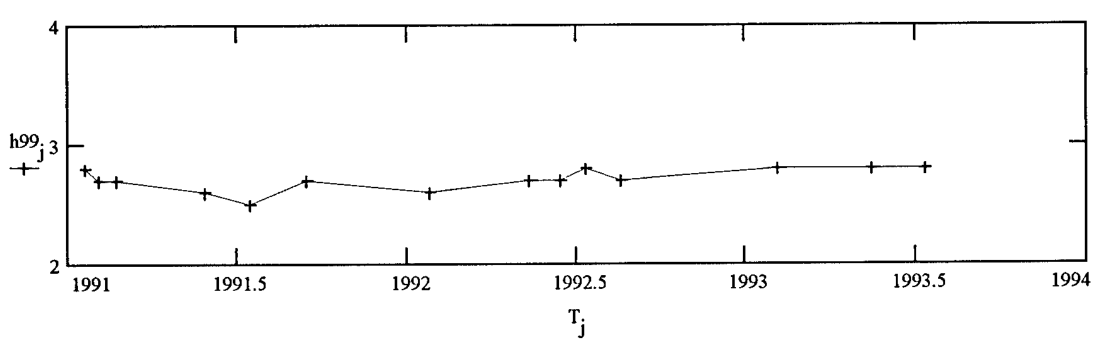
1992
1992.5
1993
1993.5
1994
T_j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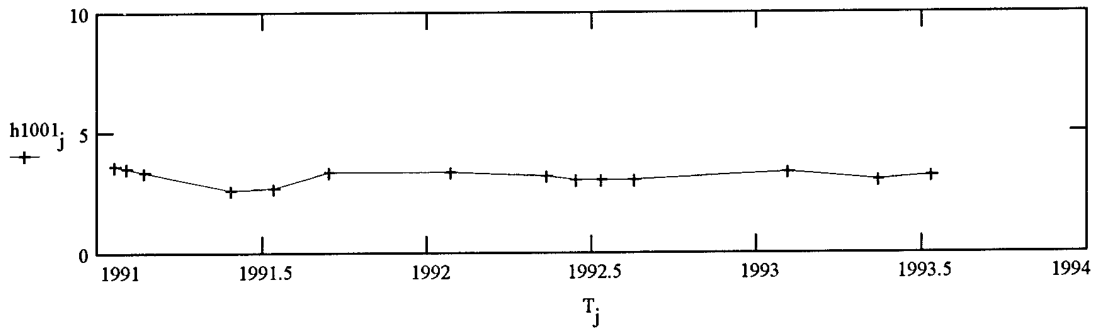
2
h99_j
1991
1991.5
1992
1992.5
1993
1993.5
1994
T_j


10
5
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h1001j
1991
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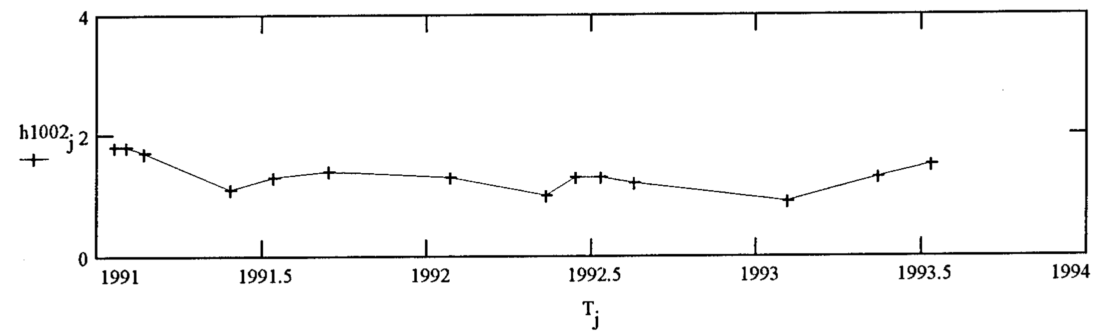
1992
1992.5
1993
1993.5
1994
Tj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1991
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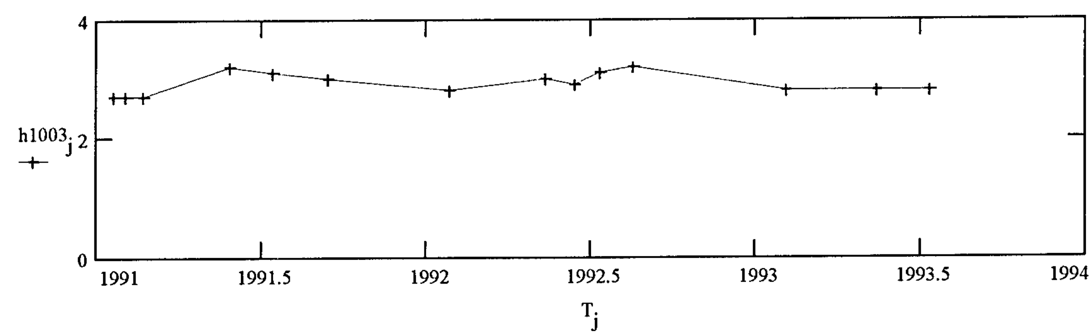
Tj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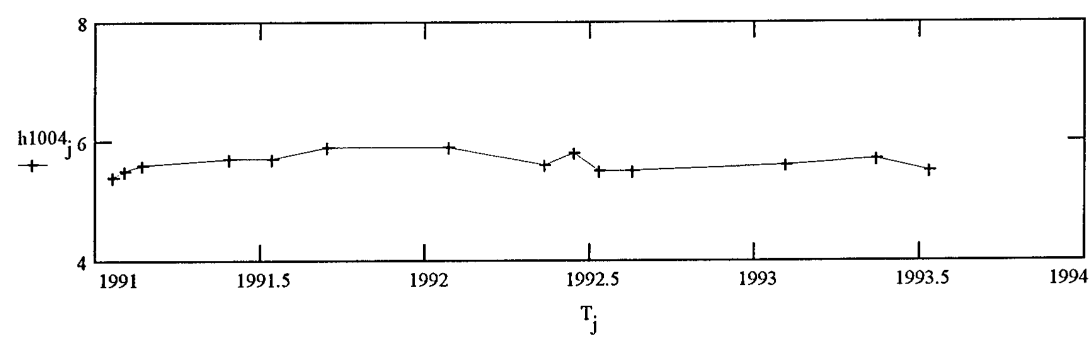
1991
1991.5
1992
1992.5
1993
1993.5
1994
Tj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6
4
h1004j
1991
1991.5
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1992.5
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1993.5
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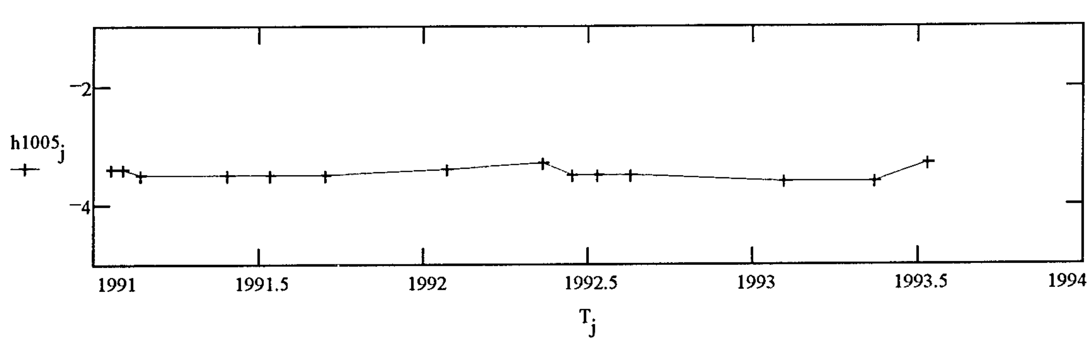
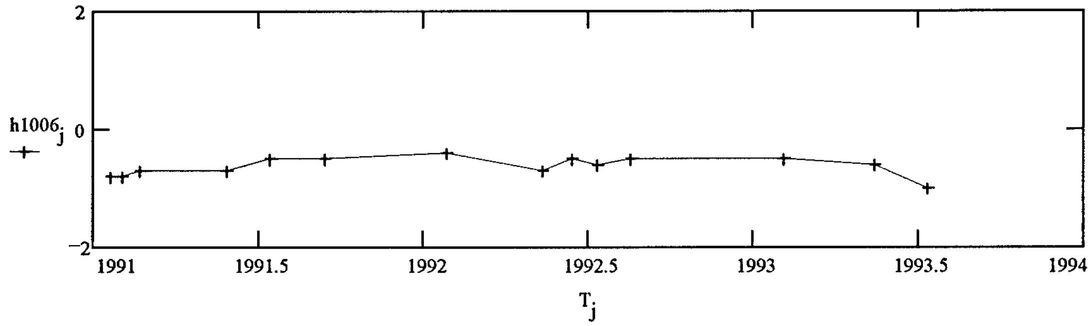
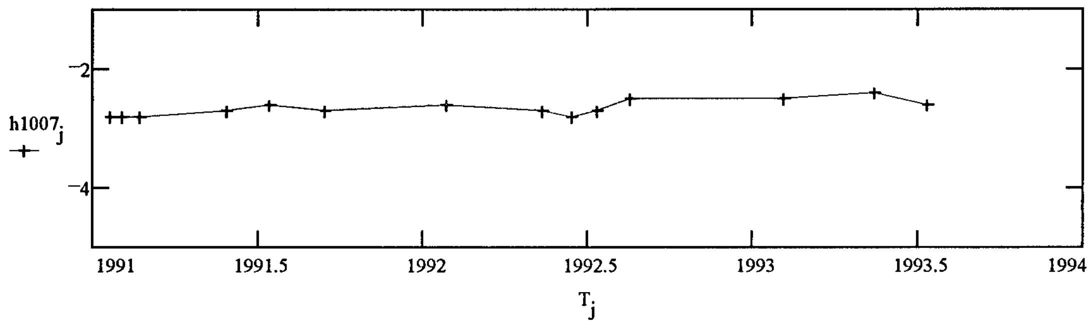
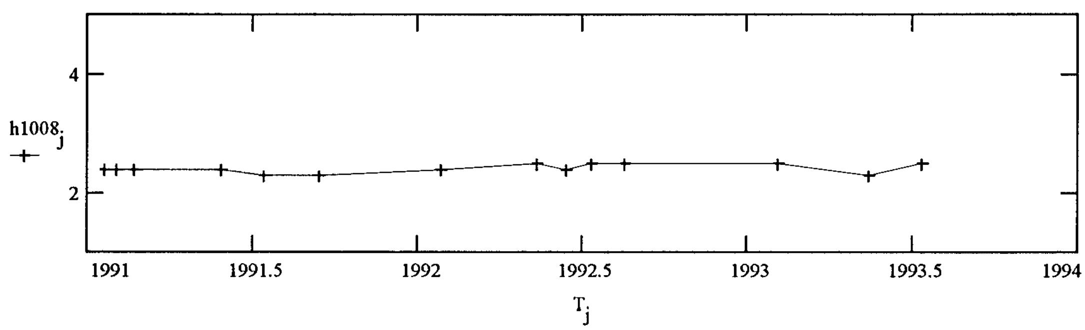
Tj


−2
−4
h1005j
1991
1991.5
1992
1992.5
1993
1993.5
1994
Tj


h1006j
2
0
−2
1991
1991.5
1992
1992.5
1993
1993.5
1994
Tj


h1007j
−2
−4
1991
1991.5
1992
1992.5
1993
1993.5
1994
Tj


h1008j
4
2
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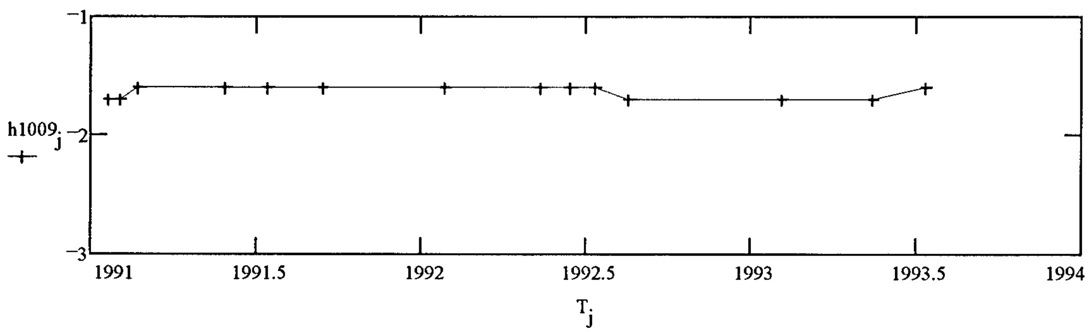
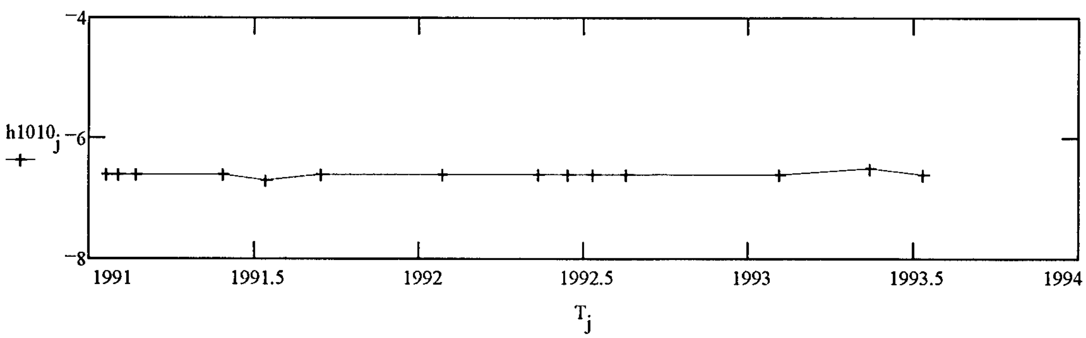
1991.5
1992
1992.5
1993
1993.5
1994
Tj


h1009j
−1
−2
−3
1991
1991.5
1992
1992.5
1993
1993.5
1994
Tj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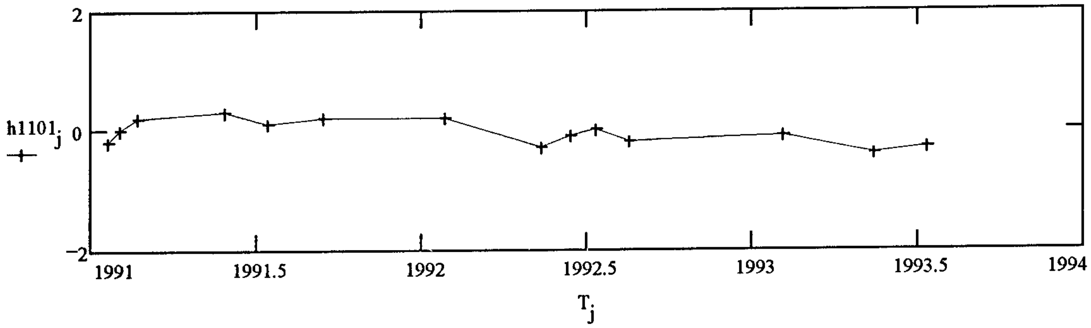
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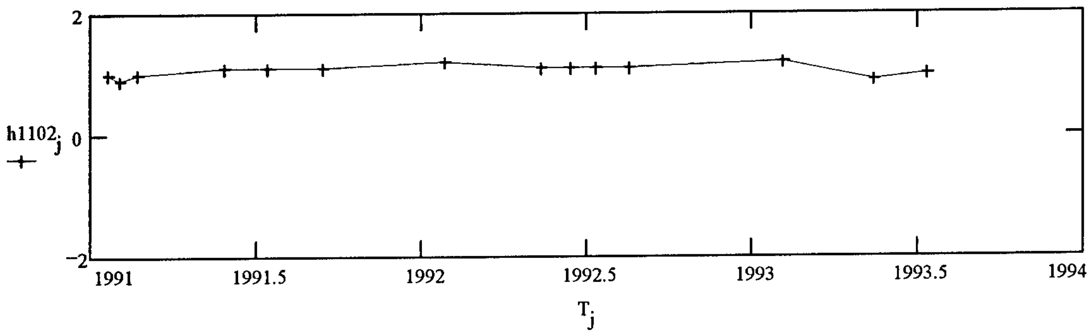
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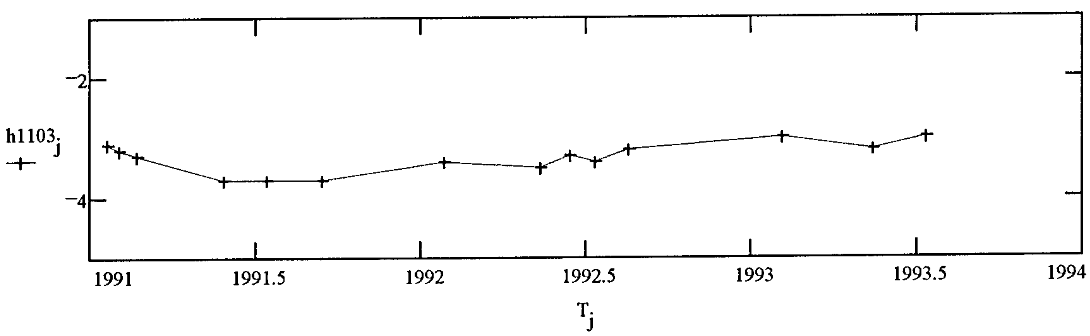
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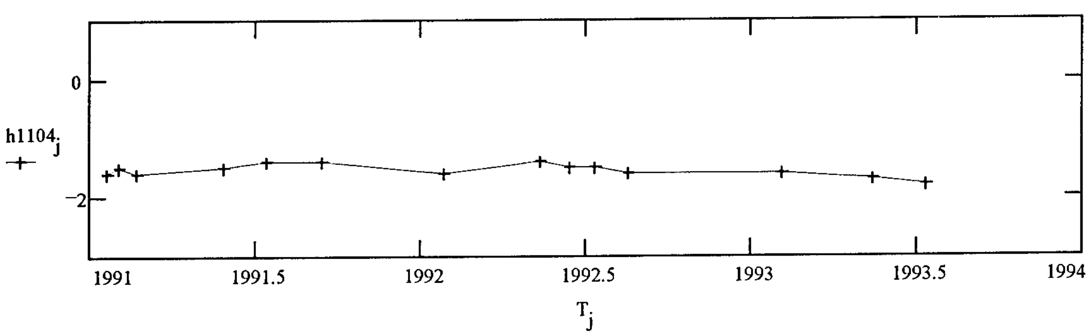
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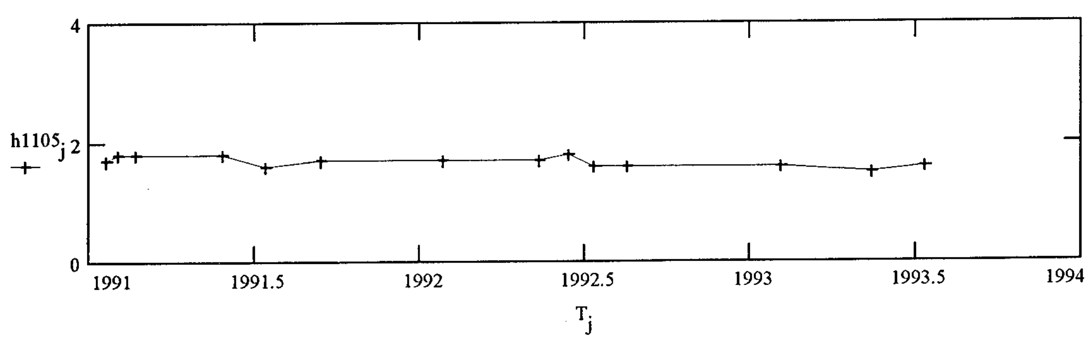
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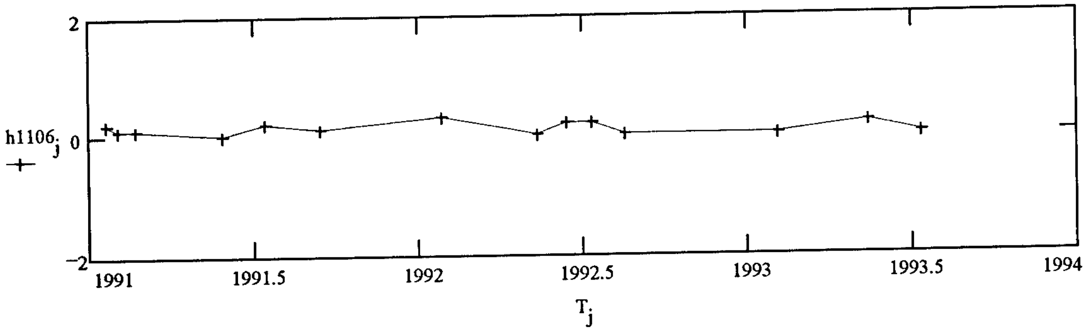
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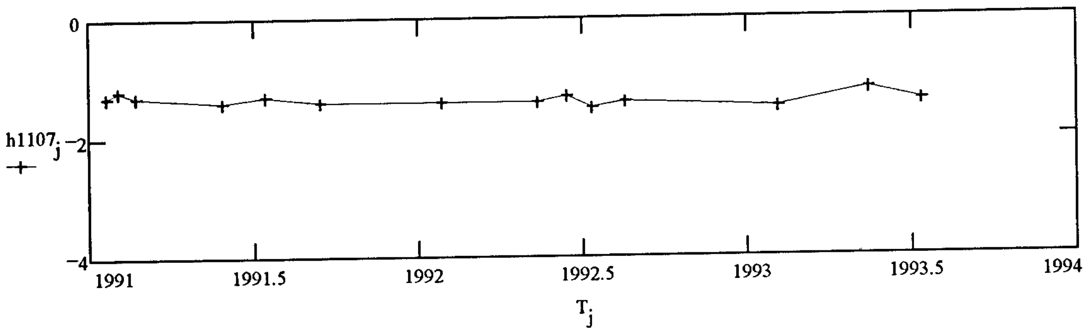
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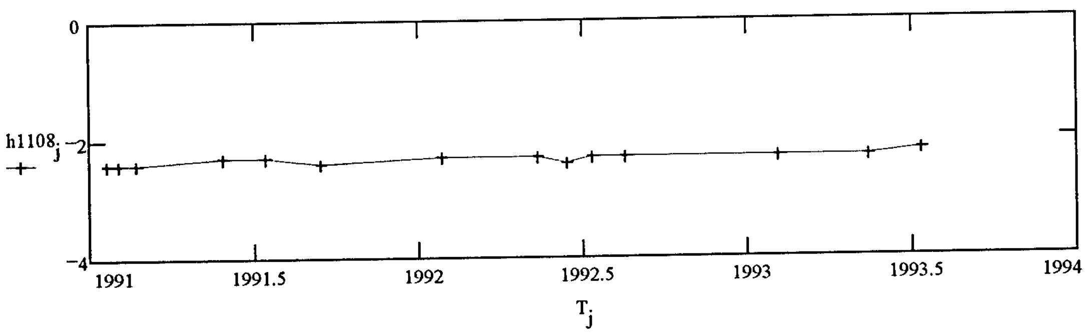
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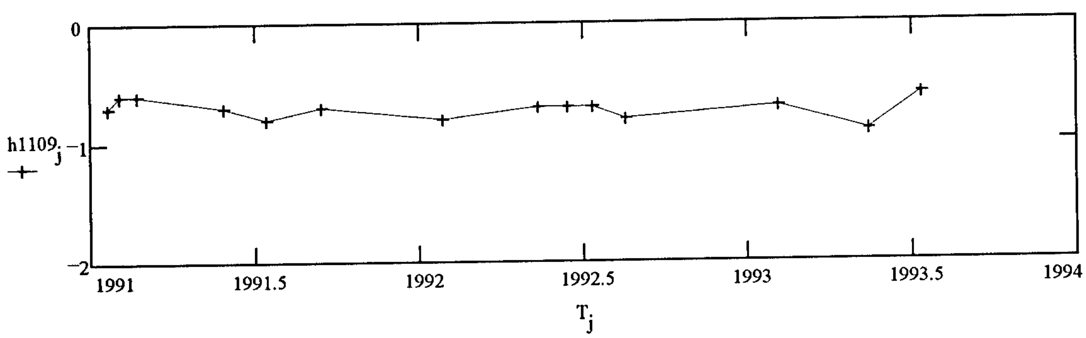
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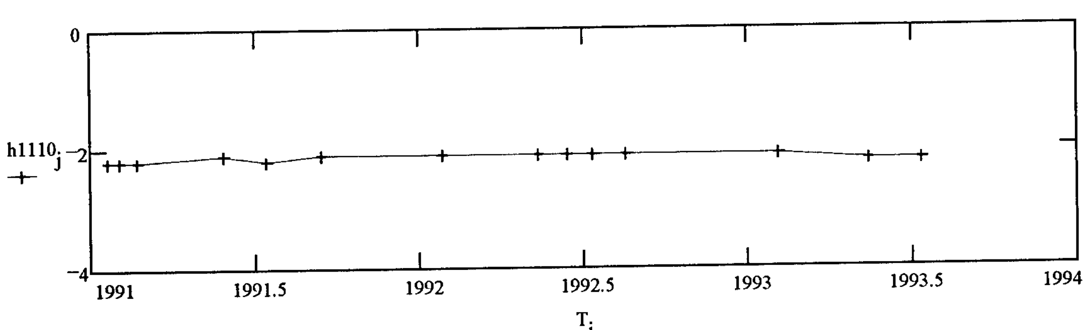
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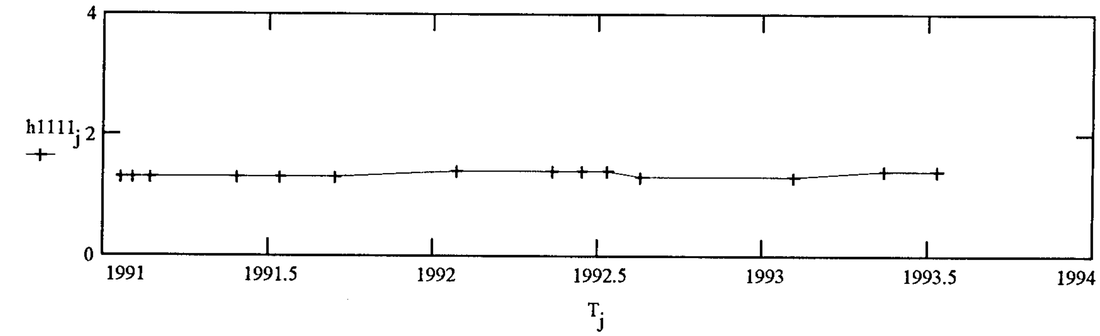
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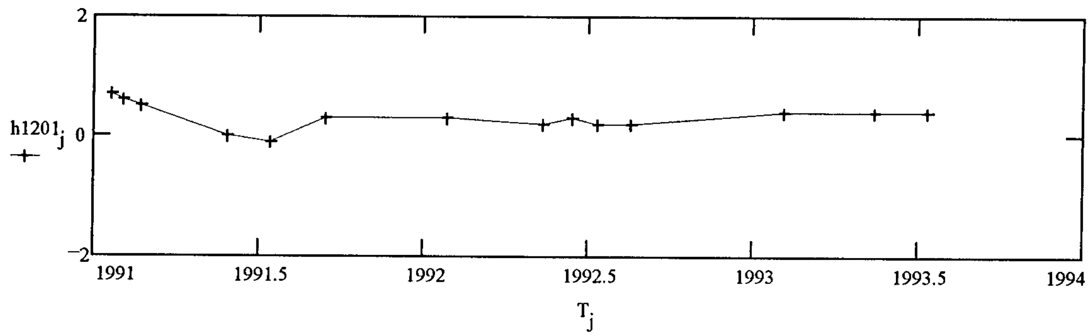
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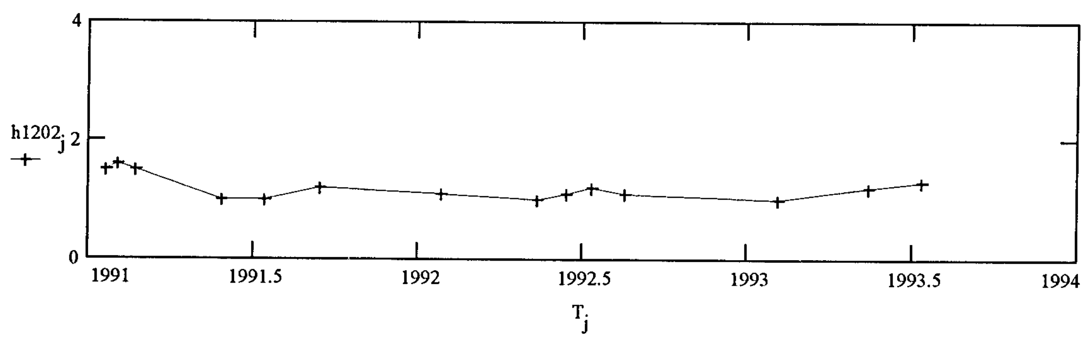
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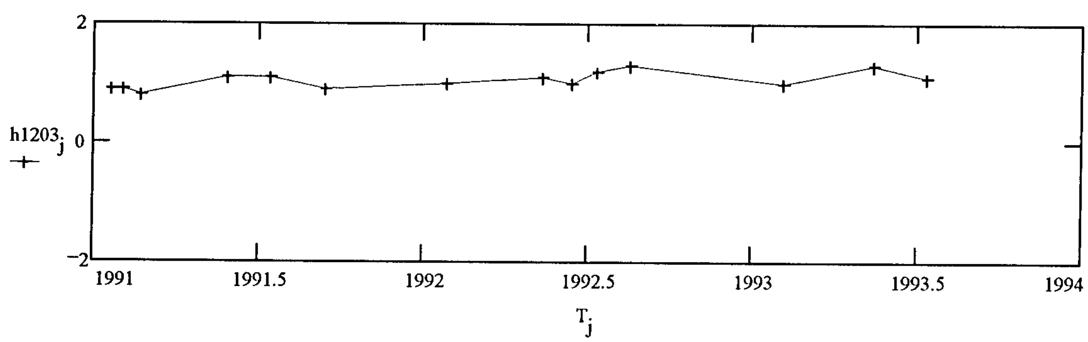
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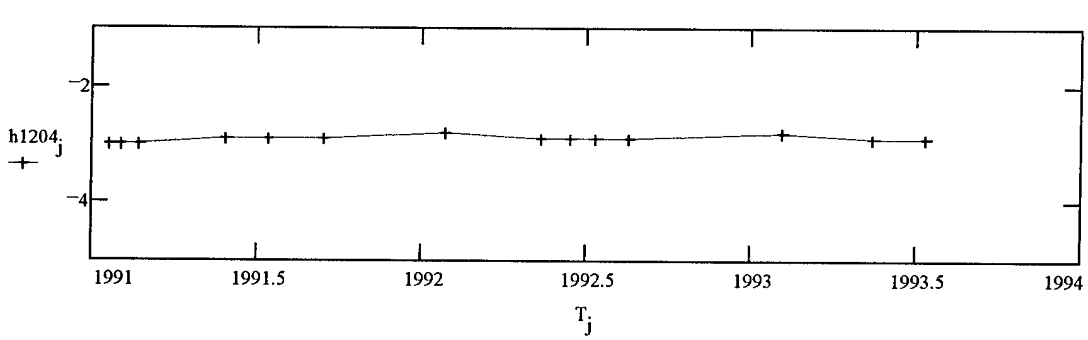
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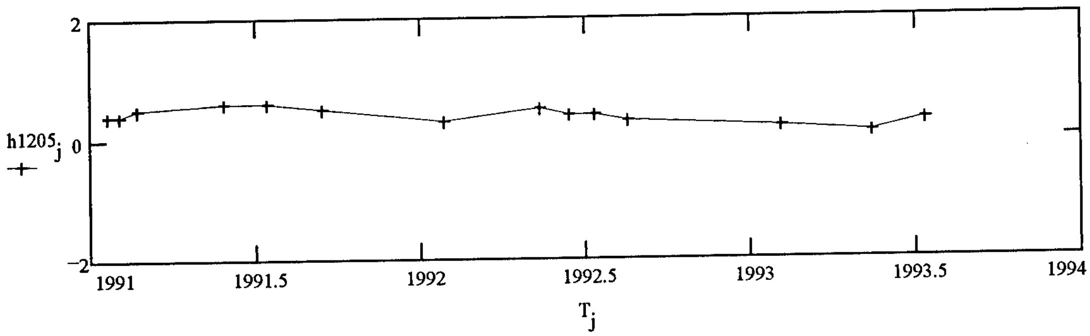
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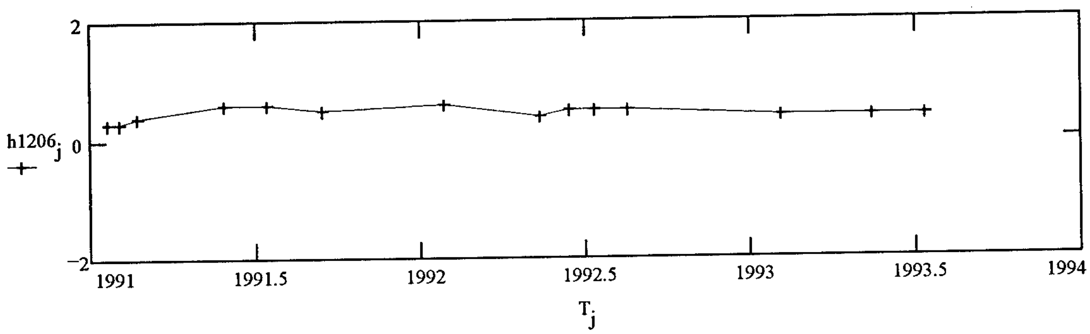
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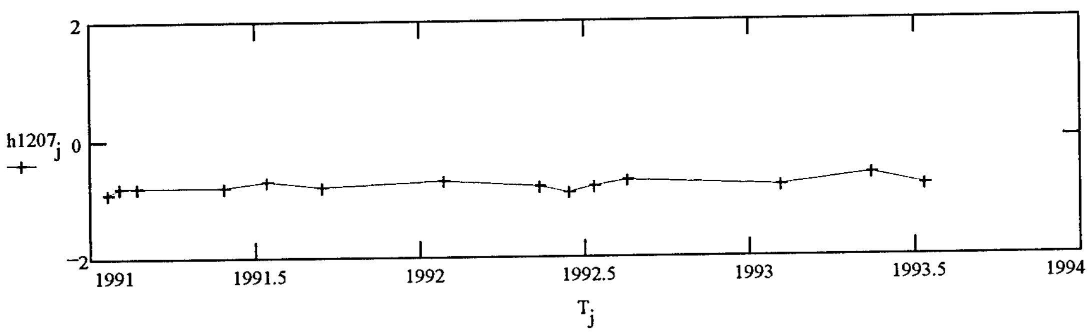
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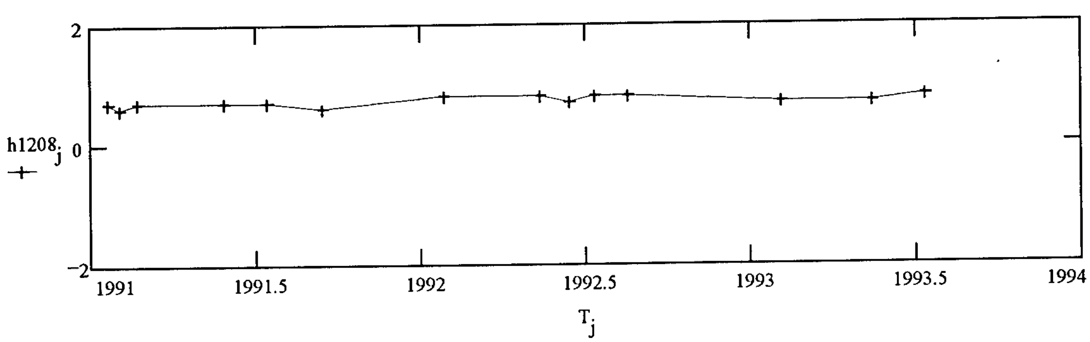
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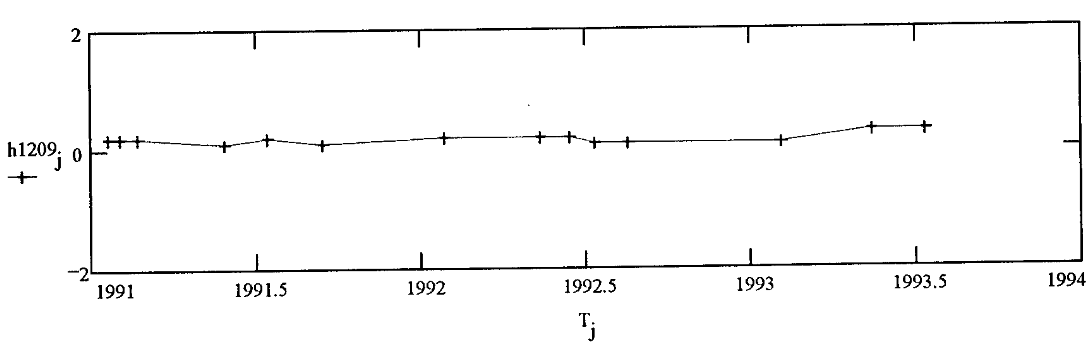
Tj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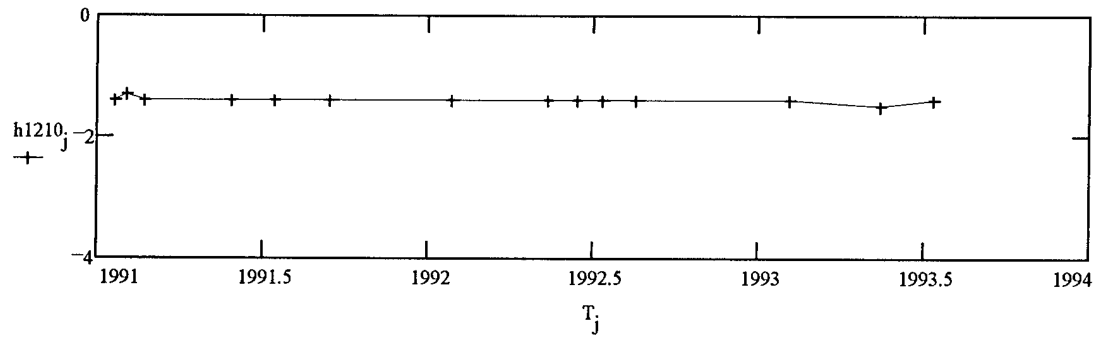
Tj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h1210j
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−4
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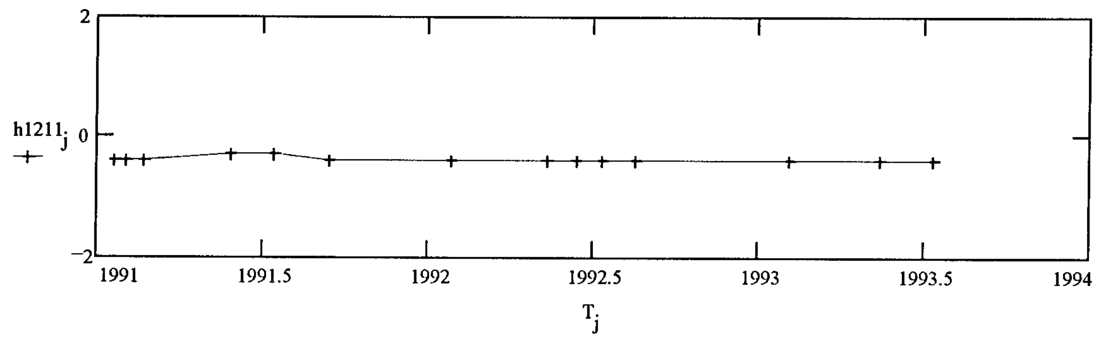
1993
1993.5
1994
Tj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h1211j
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−2
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1992.5
1993
1993.5
1994
Tj

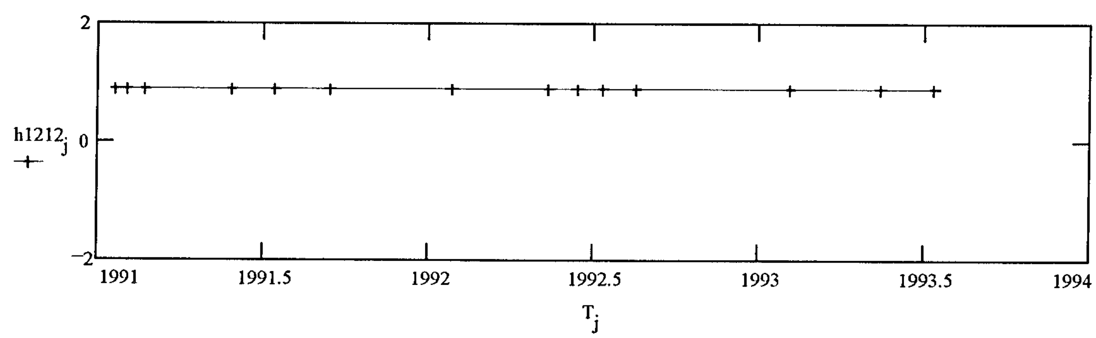

2
h1212j
0
−2
1991
1991.5
1992
1992.5
1993
1993.5
1994
Tj

Table 17. WMM-92.5 (optimum) Schmidt Normalized Gauss Coefficients

n	m	g_n^m	h_n^m	$\dot{g}_n^m$	$\dot{h}_n^m$
1	0	-29,728.767	0.000	18.515	0.000
1	1	-1,814.663	5,360.115	12.401	-17.993
2	0	-2,161.275	0.000	-13.612	0.000
2	1	3,069.051	-2,320.684	3.183	-15.218
2	2	1,686.907	-396.602	-0.308	-9.618
3	0	1,314.477	0.000	2.287	0.000
3	1	-2,256.676	-270.106	-6.635	3.980
3	2	1,248.229	296.252	-0.682	2.113
3	3	785.337	-385.921	-7.966	-12.161
4	0	937.376	0.000	0.166	0.000
4	1	781.347	254.624	0.390	2.288
4	2	308.423	-234.328	-6.591	1.248
4	3	-419.966	92.524	0.593	2.892
4	4	126.535	-302.970	-5.494	-1.529
5	0	-211.381	0.000	1.060	0.000
5	1	353.636	43.066	0.038	0.132
5	2	242.016	155.472	-1.069	1.134
5	3	-116.189	-150.883	-2.442	0.677
5	4	-162.449	-63.432	0.139	1.890
5	5	-28.572	102.206	2.510	0.907
6	0	66.286	0.000	0.930	0.000
6	1	65.579	-16.151	-0.027	0.639
6	2	62.534	77.571	0.958	-1.692
6	3	-174.393	70.482	1.886	-0.160
6	4	0.210	-53.068	-0.316	-0.691
6	5	17.505	0.937	-0.182	0.780
6	6	-91.402	28.656	0.455	1.945
7	0	78.619	0.000	0.041	0.000
7	1	-66.120	-77.208	-1.000	0.550
7	2	1.551	-25.433	-0.625	0.236
7	3	28.302	0.221	0.699	0.635
7	4	2.826	20.799	0.750	-0.288
7	5	7.059	16.851	0.346	-0.076
7	6	9.149	-23.085	0.181	-0.199
7	7	-0.500	-5.596	-0.654	-0.699
8	0	23.853	0.000	-0.141	0.000
8	1	3.873	13.793	-0.391	0.568
8	2	-1.448	-18.597	-0.177	-0.247

Table 17. WMM-92.5 (optimum) Schmidt Normalized Gauss Coefficients (Con.)

n	m	g_n^m	h_n^m	$\dot{g}_n^m$	$\dot{h}_n^m$
8	3	-10.160	6.171	0.185	0.133
8	4	-14.226	-22.006	-0.676	0.366
8	5	2.213	12.478	0.056	-0.098
8	6	3.137	9.188	0.010	-1.336
8	7	-2.474	-17.539	-0.623	-0.210
8	8	-7.701	-7.340	-0.261	-0.621
9	0	2.924	0.000	0.029	0.000
9	1	7.716	-20.264	0.071	-0.175
9	2	0.549	14.070	0.069	-0.194
9	3	-10.245	11.284	0.035	0.154
9	4	9.536	-7.220	-0.066	0.105
9	5	-2.497	-7.230	-0.082	-0.166
9	6	-2.308	9.177	0.055	-0.048
9	7	6.859	7.570	0.007	-0.063
9	8	-0.415	-8.072	0.016	-0.001
9	9	-6.464	2.725	0.018	0.055
10	0	-2.975	0.000	-0.030	0.000
10	1	-3.508	3.116	-0.096	-0.052
10	2	2.903	1.288	0.031	-0.163
10	3	-4.281	2.923	0.014	0.010
10	4	-2.953	5.638	0.047	-0.004
10	5	2.676	-3.471	0.093	-0.013
10	6	2.920	-0.625	0.040	0.019
10	7	1.046	-2.616	0.127	0.109
10	8	3.958	2.425	-0.054	0.034
10	9	3.589	-1.638	-0.012	-0.008
10	10	0.569	-6.592	-0.029	0.021
11	0	1.767	0.000	0.014	0.000
11	1	-1.409	-0.101	0.072	-0.176
11	2	-3.353	1.069	0.081	0.009
11	3	1.277	-3.295	0.015	0.134
11	4	-0.668	-1.576	-0.034	-0.074
11	5	-0.200	1.640	-0.129	-0.086
11	6	-0.737	0.108	-0.004	-0.021
11	7	-0.734	-1.370	0.044	-0.033
11	8	1.365	-2.303	0.041	0.048
11	9	-0.307	-0.729	-0.021	-0.033

Table 17. WMM-92.5 (optimum) Schmidt Normalized Gauss Coefficients (Con.)

n	m	g_n^m	h_n^m	$\dot{g}_n^m$	$\dot{h}_n^m$
11	10	2.146	-2.138	-0.015	0.011
11	11	4.070	1.357	-0.045	0.038
12	0	-1.784	0.000	0.025	0.000
12	1	0.432	0.301	-0.202	-0.018
12	2	-0.039	1.162	0.024	-0.095
12	3	-0.382	1.095	0.062	0.118
12	4	0.739	-2.891	-0.011	0.042
12	5	0.358	0.349	0.072	-0.126
12	6	0.474	0.460	-0.015	-0.003
12	7	0.536	-0.764	0.058	0.034
12	8	-0.502	0.737	-0.041	0.042
12	9	0.418	0.186	0.033	0.023
12	10	0.208	-1.410	-0.001	-0.025
12	11	0.449	-0.391	0.015	-0.016
12	12	0.414	0.900	-0.063	0.000

Table 18. WMM-90 (revised) Schmidt Normalized Gauss Coefficients

n	m	g_n^m	h_n^m	$\dot{g}_n^m$	$\dot{h}_n^m$
1	0	-29,775.1	0.0	18.6	0.0
1	1	-1,845.7	5,405.1	12.7	-17.9
2	0	-2,127.2	0.0	-13.5	0.0
2	1	3,061.1	-2,282.6	3.5	-15.3
2	2	1,687.7	-372.6	-0.4	-9.2
3	0	1,308.8	0.0	2.0	0.0
3	1	-2,240.1	-280.1	-6.7	3.8
3	2	1,249.9	291.0	-0.6	2.0
3	3	805.3	-355.5	-7.8	-12.2
4	0	937.0	0.0	0.6	0.0
4	1	780.4	248.9	0.5	2.1
4	2	324.9	-237.4	-6.8	1.3
4	3	-421.4	85.3	0.5	2.9
4	4	140.3	-299.1	-5.3	-1.4
5	0	-214.0	0.0	0.9	0.0
5	1	353.5	42.7	0.1	0.2
5	2	244.7	152.6	-1.3	1.0
5	3	-110.1	-152.6	-2.4	0.5
5	4	-162.8	-68.2	0.0	1.8
5	5	-34.8	99.9	2.3	0.9
6	0	64.0	0.0	0.9	0.0
6	1	65.6	-17.7	0.0	0.5
6	2	60.1	81.8	0.8	-1.5
6	3	-179.1	70.9	2.0	-0.3
6	4	1.0	-51.3	-0.3	-0.8
6	5	18.0	-1.0	-0.3	0.8
6	6	-92.5	23.8	0.3	1.9
7	0	78.5	0.0	-0.1	0.0
7	1	-63.6	-78.6	-0.9	0.5
7	2	3.1	-26.0	-0.6	0.3
7	3	26.6	-1.4	0.6	0.6
7	4	1.0	21.5	1.0	-0.3
7	5	6.2	17.0	0.5	-0.1
7	6	8.7	-22.6	0.1	-0.2
7	7	1.1	-3.8	-0.7	-0.6

Table 18. WMM-90 (revised) Schmidt Normalized Gauss Coefficients (Con.)

n	m	g_n^m	h_n^m	$\dot{g}_n^m$	$\dot{h}_n^m$
8	0	24.2	0.0	0.1	0.0
8	1	4.9	12.4	-0.3	0.5
8	2	-1.0	-18.0	-0.1	-0.3
8	3	-10.6	5.8	0.2	0.1
8	4	-12.5	-22.9	-0.8	0.5
8	5	2.1	12.7	0.1	-0.1
8	6	3.1	12.5	0.1	-1.1
8	7	-0.9	-17.0	-0.8	-0.4
8	8	-7.0	-5.8	-0.3	-0.6
9	0	2.9	0.0	0.0	0.0
9	1	7.5	-19.8	0.0	0.0
9	2	0.4	14.6	0.0	0.0
9	3	-10.3	10.9	0.0	0.0
9	4	9.7	-7.5	0.0	0.0
9	5	-2.3	-6.8	0.0	0.0
9	6	-2.4	9.3	0.0	0.0
9	7	6.8	7.7	0.0	0.0
9	8	-0.5	-8.1	0.0	0.0
9	9	-6.5	2.6	0.0	0.0
10	0	-2.9	0.0	0.0	0.0
10	1	-3.3	3.2	0.0	0.0
10	2	2.8	1.7	0.0	0.0
10	3	-4.3	2.9	0.0	0.0
10	4	-3.1	5.6	0.0	0.0
10	5	2.4	-3.4	0.0	0.0
10	6	2.8	-0.7	0.0	0.0
10	7	0.7	-2.9	0.0	0.0
10	8	4.1	2.3	0.0	0.0
10	9	3.6	-1.6	0.0	0.0
10	10	0.6	-6.6	0.0	0.0
11	0	1.7	0.0	0.0	0.0
11	1	-1.6	0.3	0.0	0.0
11	2	-3.6	1.0	0.0	0.0
11	3	1.2	-3.6	0.0	0.0
11	4	-0.6	-1.4	0.0	0.0

Table 18. WMM-90 (revised) Schmidt Normalized Gauss Coefficients (Con.)

n	m	g_n^m	h_n^m	$\dot{g}_n^m$	$\dot{h}_n^m$
11	5	0.1	1.9	0.0	0.0
11	6	-0.7	0.2	0.0	0.0
11	7	-0.8	-1.3	0.0	0.0
11	8	1.3	-2.4	0.0	0.0
11	9	-0.3	-0.6	0.0	0.0
11	10	2.2	-2.2	0.0	0.0
11	11	4.2	1.3	0.0	0.0
12	0	-1.8	0.0	0.0	0.0
12	1	0.9	0.3	0.0	0.0
12	2	-0.1	1.4	0.0	0.0
12	3	-0.5	0.8	0.0	0.0
12	4	0.8	-3.0	0.0	0.0
12	5	0.2	0.7	0.0	0.0
12	6	0.5	0.5	0.0	0.0
12	7	0.4	-0.8	0.0	0.0
12	8	-0.4	0.6	0.0	0.0
12	9	0.3	0.1	0.0	0.0
12	10	0.2	-1.3	0.0	0.0
12	11	0.4	-0.4	0.0	0.0
12	12	0.6	0.9	0.0	0.0

3.1 The WMM-95 Model

Truncating the SV portion of the WMM-92.5 (*optimum*) model to degree and order 8 yields the WMM-92.5(A) SV model in table 4. This SV model was averaged with another degree and order 8 SV model (WMM-92.5(B) SV), which was derived independently by the BGS and which is also listed in table 4. The resulting degree and order 8 SV model was then used to adjust the full degree and order 12 WMM-92.5 (*optimum*) MF model coefficients forward 2.5 years to yield MF Gauss coefficients at the 1995.0 epoch. When merged with the Predictive 1997.5 SV model, which was also supplied by the BGS, the desired 1995 Epoch World Magnetic Model listed in table 3 results. The BGS method for determining the WMM-92.5(B) SV model and the Predictive 1997.5 SV model is discussed by Macmillan (1994).

An indication of the erratic nature of the geomagnetic field is provided by the wanderings of the North Geomagnetic Pole and the South Geomagnetic Pole. The movements of these poles, which are sometimes referred to as *Dip poles*, since 1945 are illustrated in charts 61 and 62. These charts are derived from the Definitive International Geomagnetic Reference Field (DGRF) models, the WMM-90 (revised) model and the WMM-95 model. The pole movements illustrate a poorly understood phenomena known as the *geomagnetic jerk* which occurred around 1970. It is more pronounced for the South Magnetic Pole movement, which exhibits a sudden change in direction at about that time. These jerks occur only a few times per century and are thought to be due to the sudden release of energy built up over a long period at the core-mantle boundary. This build-up is presumed to arise as a consequence of electromagnetic coupling between the top of the fluid core and the bottom of the lower mantle, both of which have substantial electrical conductivities. These jerks have been correlated to *irregular changes* in the *Length-of-Day*. The numerical values of the pole positions at 1-year intervals for both poles are listed in table 19.

It should be noted that roughly 90 percent of the Earth's magnetic field is contained in the degree-1 spherical-harmonic coefficients: g_1^0, h_1^0, and h_1^1. These three coefficients characterize the Earth's magnetic dipole field and form the basis of the geomagnetic coordinate system, which for the 1995 epoch is illustrated in chart 63. The axis of the *geomagnetic coordinate system* pierces the Earth's surface at the poles of the Earth's *magnetic dipole*. These poles are different from the *geomagnetic dip poles* which are derived from the full degree and order 12 model. The location of the dipole poles is determined when the horizontal (**H**) component, computed from just the degree-1 spherical-harmonic coefficients, is equal to zero. The dip poles on the other hand are determined when the **H** component of the magnetic field, computed from the full set of degree-12 spherical-harmonic coefficients, is equal to zero. For the WMM-95 model at 1995.0, the North-magnetic dipole pole-position is located at 79.30 degrees latitude and -71.46 degrees longitude, while the South-magnetic dipole pole-position is located at -79.30 degrees latitude and +108.54 degrees longitude. The displacement vector for the eccentric (off-center) dipole for 1995.0 in the usual Earth-fixed spherical coordinate system (i.e., **Z**-axis is the rotation axis (positive North), **X**-axis points to the prime meridian, and the **Y**-axis is orthogonal to the other two, thereby creating a right-handed system) is 527.20 km radially outward from the Earth's center, with a colatitude of 21.43 degrees and a longitude of 144.77 degrees. The off-center dipole pole-positions are computed from the degree and order 1 and 2 spherical-harmonic Gauss coefficients.

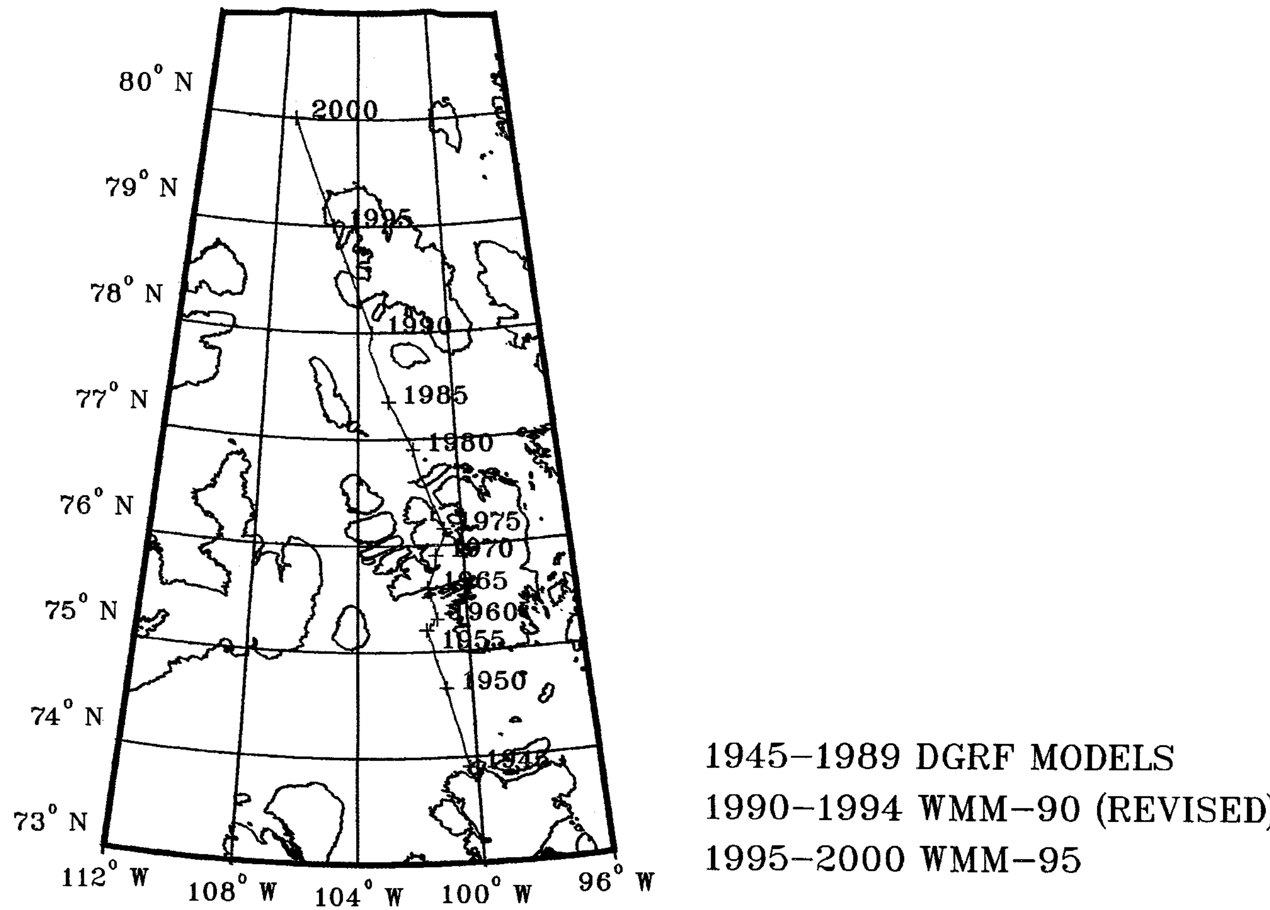


Chart 61. North Magnetic Pole Movement: 1945 - 2000

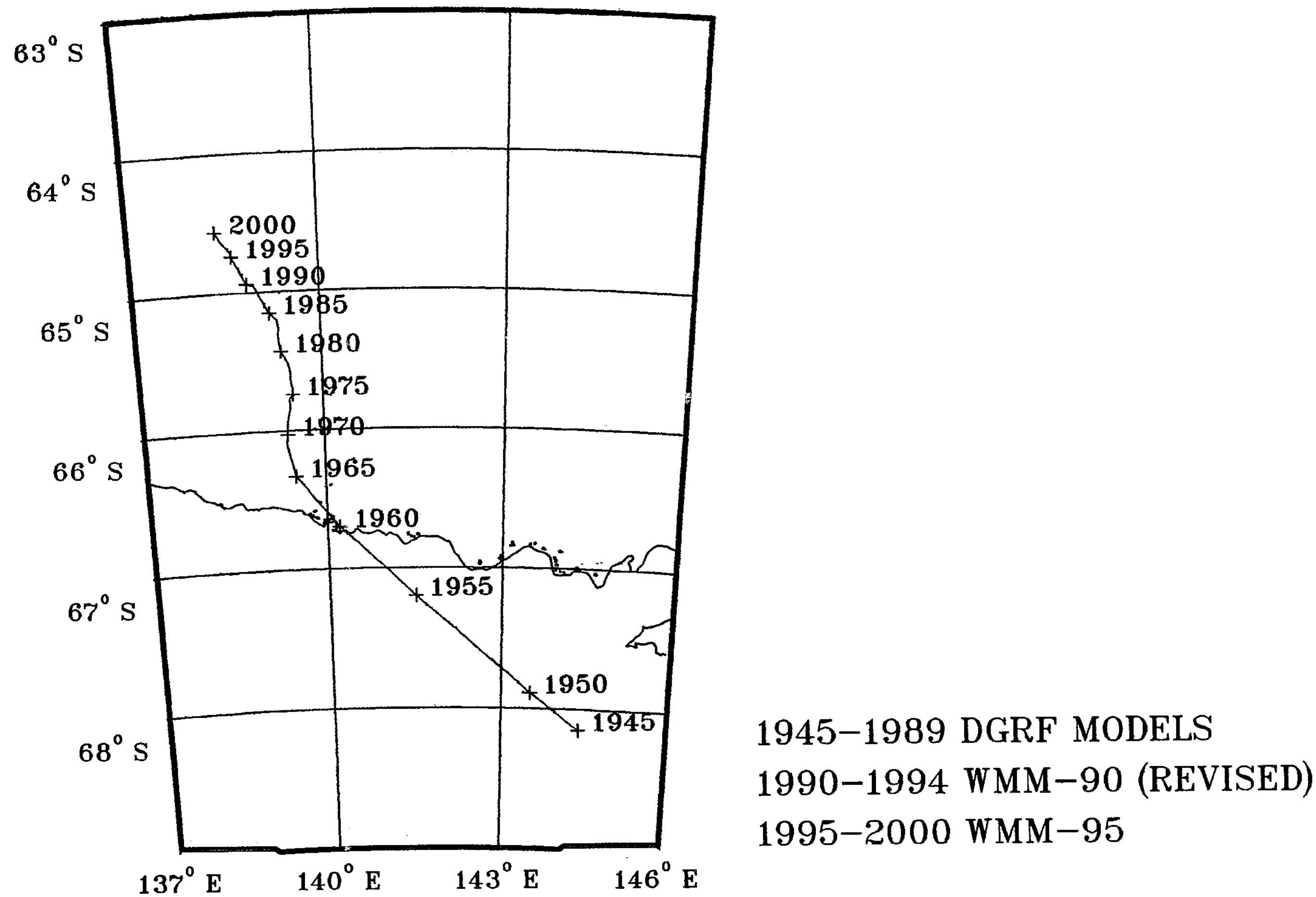
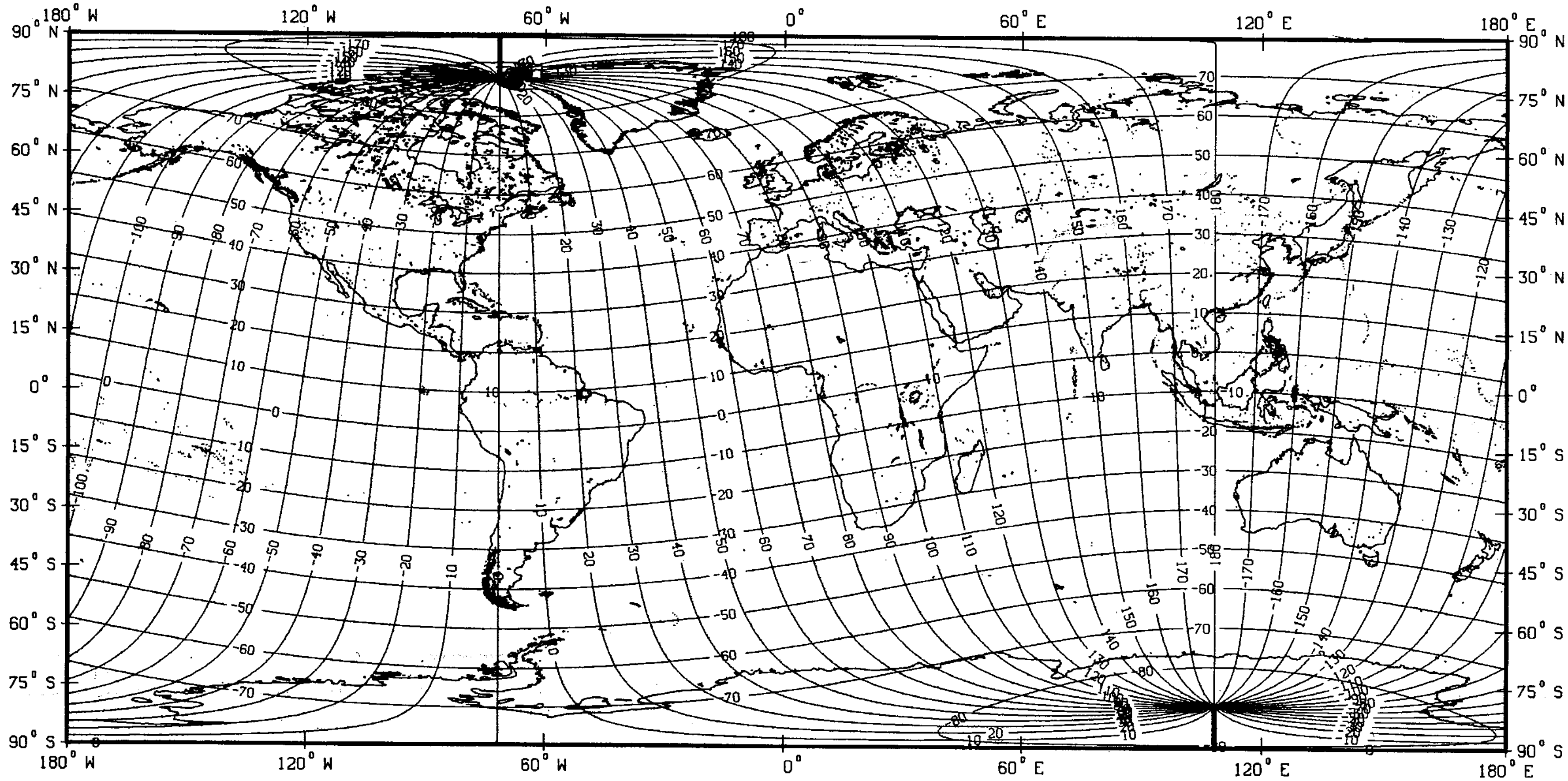


Chart 62. South Magnetic Pole Movement: 1945 - 2000

Table 19. North and South Magnetic Pole Positions: 1945 - 2000

		North Pole		South Pole	
		Latitude	Longitude	Latitude	Longitude
	Year	degrees	degrees	degrees	degrees
1	1945.000	73.90	-100.20	-68.15	144.42
2	1946.000	74.05	-100.35	-68.10	144.25
3	1947.000	74.20	-100.45	-68.05	144.08
4	1948.000	74.35	-100.60	-68.00	143.91
5	1949.000	74.50	-100.75	-67.94	143.71
6	1950.000	74.65	-100.85	-67.89	143.53
7	1951.000	74.75	-100.95	-67.75	143.12
8	1952.000	74.85	-101.10	-67.62	142.72
9	1953.000	74.95	-101.20	-67.48	142.31
10	1954.000	75.05	-101.25	-67.34	141.90
11	1955.000	75.20	-101.45	-67.20	141.50
12	1956.000	75.20	-101.35	-67.10	141.24
13	1957.000	75.25	-101.30	-67.00	140.99
14	1958.000	75.25	-101.20	-66.91	140.75
15	1959.000	75.30	-101.15	-66.81	140.50
16	1960.000	75.30	-101.05	-66.70	140.21
17	1961.000	75.35	-101.10	-66.63	140.08
18	1962.000	75.45	-101.15	-66.55	139.93
19	1963.000	75.50	-101.25	-66.48	139.79
20	1964.000	75.55	-101.25	-66.41	139.67
21	1965.000	75.60	-101.35	-66.33	139.51
22	1966.000	75.65	-101.25	-66.27	139.48
23	1967.000	75.70	-101.20	-66.21	139.44
24	1968.000	75.75	-101.10	-66.15	139.41
25	1969.000	75.80	-101.05	-66.09	139.38
26	1970.000	75.90	-101.00	-66.03	139.40
27	1971.000	75.95	-100.90	-65.96	139.40
28	1972.000	76.00	-100.80	-65.90	139.43
29	1973.000	76.05	-100.70	-65.84	139.46
30	1974.000	76.10	-100.60	-65.77	139.46
31	1975.000	76.15	-100.65	-65.74	139.51
32	1976.000	76.30	-100.85	-65.69	139.51
33	1977.000	76.40	-101.05	-65.63	139.49
34	1978.000	76.55	-101.25	-65.58	139.49
35	1979.000	76.65	-101.45	-65.52	139.46
36	1980.000	76.90	-101.70	-65.43	139.35
37	1981.000	77.00	-101.90	-65.37	139.33
38	1982.000	77.10	-102.10	-65.31	139.32
39	1983.000	77.20	-102.30	-65.26	139.33
40	1984.000	77.30	-102.55	-65.20	139.31
41	1985.000	77.35	-102.65	-65.15	139.19
42	1986.000	77.45	-102.75	-65.10	139.13
43	1987.000	77.60	-103.05	-65.05	139.07
44	1988.000	77.70	-103.15	-65.00	139.02
45	1989.000	77.85	-103.45	-64.95	138.96
46	1990.000	78.00	-103.30	-64.94	138.86
47	1991.000	78.20	-103.65	-64.90	138.81
48	1992.000	78.40	-104.00	-64.86	138.77
49	1993.000	78.60	-104.35	-64.82	138.73
50	1994.000	78.80	-104.75	-64.78	138.68
51	1995.000	79.00	-105.10	-64.74	138.64
52	1996.000	79.20	-105.50	-64.71	138.63
53	1997.000	79.40	-105.95	-64.67	138.55
54	1998.000	79.60	-106.35	-64.63	138.49
55	1999.000	79.80	-106.80	-64.60	138.46
56	2000.000	80.00	-107.25	-64.56	138.40



AT 1995.0

units: degrees

Chart 63. Geomagnetic Coordinate System: 1995.0 Epoch

A 5-degree grid of MF and SV values for seven components (**X**, **Y**, **Z**, **H**, **F**, **D**, **I**) of the Earth's magnetic field derived from WMM-95 are tabulated in table 20. Contours of five of these components (**Z**, **H**, **F**, **D**, **I**) for the MF are illustrated in charts 64 through 68, while contours of the SV for these five components are illustrated in charts 69 through 73. These charts are plotted on a *corrected* Mercator projection. North polar stereographic projections of contours for these same five components plus the Grid Variation are illustrated in charts 74 through 79, while corresponding SV contours of these components for the north pole are illustrated in charts 80 through 85. Similarly, for the south polar region, the main field contours are given in charts 86 through 91, while the corresponding Secular Variation contours are illustrated in charts 92 through 97. The magnetic field components contoured on both the Mercator and the polar stereographic charts were generated with respect to the 1984 World Geodetic System (WGS-84) ellipsoid at the 1995.0 Epoch for the MF and at the 1997.5 Epoch for the SV using gridded data derived from the WMM-95 model and the GEOMAG algorithm.

TABLE 20.

WMM-95 MAIN FIELD AND ANNUAL CHANGE GRID VALUES

$$\text{units:} \begin{cases} \text{MF} & \text{nT} \\ \text{SV} & \text{nT/yr} \end{cases}$$

(Pages 239-323)

NORTH COMPONENT (X) WMM-95

E. Long	0	5	10	15	20	25	30	35	40	45	50	55	E. Long
Lat 90	1836.6 2.1	1924.5 0.3	1997.7 -1.5	2055.7 -3.2	2098.0 -5.0	2124.4 -6.7	2134.7 -8.3	2128.6 -9.9	2106.4 -11.4	2068.2 -12.8	2014.2 -14.2	1944.9 -15.4	Lat 90
85	4395.2 -2.5	4493.2 -4.4	4546.5 -6.3	4555.3 -8.0	4520.4 -9.5	4443.8 -10.9	4328.2 -12.1	4177.0 -13.2	3994.5 -14.2	3785.3 -14.9	3554.9 -15.6	3308.9 -16.2	85
80	6654.9 -4.0	6768.2 -6.3	6818.9 -8.3	6807.5 -10.1	6735.8 -11.7	6606.4 -13.0	6423.0 -14.2	6190.3 -15.2	5914.1 -16.0	5601.2 -16.6	5259.3 -17.1	4897.1 -17.4	80
75	8736.1 -3.1	8855.6 -5.6	8906.6 -7.8	8890.9 -9.8	8810.6 -11.5	8668.7 -13.0	8468.7 -14.2	8214.9 -15.2	7912.4 -16.1	7567.6 -16.8	7187.9 -17.4	6782.3 -17.9	75
70	10767.5 -0.7	10876.3 -3.5	10920.4 -5.9	10903.4 -8.0	10828.5 -9.8	10698.9 -11.3	10517.9 -12.5	10288.5 -13.6	10014.2 -14.5	9699.4 -15.3	9349.3 -16.1	8971.1 -16.8	70
65	12853.9 2.3	12935.5 -0.8	12961.8 -3.5	12938.9 -5.7	12871.9 -7.5	12765.0 -8.9	12621.2 -10.0	12442.6 -10.8	12231.1 -11.5	11988.7 -12.3	11718.3 -13.0	11423.9 -13.8	65
60	15064.4 5.4	15108.3 1.8	15108.0 -1.3	15073.0 -3.7	15010.7 -5.5	14926.7 -6.7	14824.1 -7.4	14704.7 -7.8	14569.5 -8.1	14419.4 -8.5	14255.3 -8.9	14079.0 -9.5	60
55	17433.1 8.4	17438.9 4.0	17410.5 0.4	17360.8 -2.2	17299.9 -3.9	17234.3 -4.8	17167.7 -5.1	17102.0 -5.1	17038.6 -5.0	16979.0 -4.9	16924.7 -4.9	16876.3 -5.2	55
50	19963.8 11.3	19944.1 6.1	19896.7 2.0	19837.9 -0.8	19779.6 -2.5	19728.9 -3.1	19689.2 -3.1	19663.0 -2.8	19653.9 -2.4	19666.8 -2.1	19706.1 -2.0	19773.8 -1.9	50
45	22626.1 13.9	22606.5 8.3	22561.4 3.9	22509.4 1.1	22462.9 -0.4	22428.0 -0.8	22407.3 -0.8	22404.2 -0.6	22426.2 -0.5	22484.3 -0.5	22589.2 -0.6	22746.3 -0.4	45
40	25344.6 16.3	25359.1 10.6	25346.3 6.5	25325.4 4.0	25307.5 2.8	25296.0 2.5	25291.6 2.3	25299.3 1.9	25332.1 1.1	25409.2 0.1	25549.8 -0.6	25764.7 -0.7	40
35	27986.7 18.3	28069.1 13.2	28119.9 9.8	28156.9 7.9	28187.9 7.2	28212.5 6.7	28229.4 5.9	28245.0 4.5	28278.8 2.4	28359.3 0.1	28514.7 -1.6	28761.4 -2.3	35
30	30359.4 19.5	30534.7 15.6	30673.8 13.3	30790.6 12.2	30888.8 11.7	30963.9 11.0	31013.0 9.4	31044.9 6.7	31084.8 3.2	31169.8 -0.3	31335.5 -3.0	31602.4 -4.2	30
25	32223.0 19.7	32503.3 17.2	32744.2 15.9	32953.7 15.4	33130.6 14.9	33267.9 13.6	33363.0 11.1	33428.0 7.4	33493.0 3.0	33600.3 -1.2	33789.3 -4.3	34082.2 -5.4	25
20	33323.0 18.3	33709.3 17.1	34055.1 16.5	34360.4 16.1	34619.3 15.1	34825.1 13.0	34978.9 9.8	35097.2 5.5	35213.9 1.0	35372.3 -2.9	35610.9 -5.2	35949.9 -5.6	20
15	33440.2 15.0	33924.4 14.6	34369.4 14.0	34765.0 12.9	35101.9 10.9	35376.7 8.0	35597.9 4.3	35788.5 0.4	35984.3 -3.1	36225.7 -5.3	36545.8 -5.8	36959.0 -4.4	15
10	32450.4 9.3	33013.1 8.9	33540.2 7.6	34011.0 5.3	34414.3 2.2	34753.2 -1.5	35046.2 -5.0	35323.8 -7.8	35622.6 -9.0	35976.8 -8.5	36409.2 -6.2	36926.3 -2.4	10
5	30376.4 0.7	30979.6 -0.1	31554.1 -2.5	32071.0 -6.1	32519.8 -10.3	32912.1 -14.2	33277.2 -16.9	33652.7 -17.5	34073.6 -15.8	34564.6 -11.9	35135.7 -6.4	35782.8 -0.1	5
0 Lat	27412.5 -10.8	27993.7 -12.3	28558.6 -15.6	29075.7 -20.0	29538.7 -24.4	29967.9 -27.7	30401.8 -28.7	30881.7 -26.8	31437.9 -21.8	32082.3 -14.6	32810.0 -6.2	33604.8 2.1	0 Lat
E. Long	0	5	10	15	20	25	30	35	40	45	50	55	E. Long

NORTH COMPONENT (X) WMM-95

E. Long	60	65	70	75	80	85	90	95	100	105	110	115	E. Long
Lat													Lat
90	1860.8	1762.5	1650.8	1526.5	1390.6	1244.2	1088.2	924.0	752.8	575.8	394.5	210.1	90
	-16.5	-17.5	-18.3	-19.0	-19.6	-20.0	-20.3	-20.4	-20.3	-20.1	-19.7	-19.2	
85	3053.4	2794.3	2537.8	2289.6	2055.1	1839.2	1645.8	1478.2	1338.5	1228.0	1146.5	1092.9	85
	-16.6	-16.9	-17.2	-17.3	-17.5	-17.5	-17.6	-17.6	-17.6	-17.7	-17.6	-17.6	
80	4524.1	4150.3	3786.3	3442.5	3129.1	2855.8	2630.9	2461.2	2351.6	2304.7	2320.4	2396.0	80
	-17.6	-17.8	-17.8	-17.8	-17.8	-17.8	-17.8	-17.8	-18.0	-18.2	-18.5	-18.9	
75	6361.2	5936.2	5520.5	5128.0	4772.9	4469.6	4231.1	4068.7	3991.1	4003.6	4107.4	4299.3	75
	-18.3	-18.6	-18.9	-19.1	-19.2	-19.4	-19.7	-20.0	-20.4	-20.9	-21.6	-22.5	
70	8573.6	8167.6	7766.2	7384.2	7038.1	6744.8	6521.2	6382.8	6342.0	6407.6	6582.7	6864.7	70
	-17.5	-18.2	-18.8	-19.5	-20.2	-20.9	-21.7	-22.6	-23.5	-24.6	-25.8	-27.1	
65	11111.3	10788.3	10465.1	10154.4	9871.4	9633.0	9457.3	9361.9	9362.5	9470.6	9692.1	10025.8	65
	-14.7	-15.7	-16.8	-18.0	-19.4	-20.8	-22.5	-24.2	-26.0	-27.9	-29.8	-31.6	
60	13892.6	13699.5	13504.8	13315.6	13142.4	12998.3	12899.1	12862.2	12904.4	13039.6	13276.6	13616.6	60
	-10.4	-11.4	-12.7	-14.3	-16.3	-18.6	-21.2	-24.0	-26.9	-29.8	-32.6	-35.0	
55	16833.2	16793.6	16755.7	16718.8	16685.2	16661.0	16656.4	16685.5	16764.1	16907.6	17127.5	17428.6	55
	-5.7	-6.4	-7.6	-9.3	-11.6	-14.6	-18.1	-22.0	-26.1	-30.1	-33.6	-36.5	
50	19867.6	19980.7	20103.4	20226.0	20340.7	20444.4	20539.3	20633.4	20739.4	20872.5	21046.9	21271.2	50
	-1.9	-2.1	-2.8	-4.2	-6.5	-9.8	-14.1	-18.9	-24.0	-28.7	-32.7	-35.6	
45	22952.9	23197.6	23463.0	23730.1	23981.6	24204.6	24391.8	24543.4	24666.6	24774.3	24882.4	25003.4	45
	0.0	0.4	0.5	-0.3	-2.3	-5.7	-10.3	-15.7	-21.3	-26.3	-30.1	-32.5	
40	26051.4	26394.4	26769.9	27151.0	27512.7	27833.3	28096.7	28293.5	28423.4	28495.5	28525.2	28528.7	40
	-0.2	0.8	1.6	1.6	0.1	-3.1	-7.8	-13.3	-18.8	-23.4	-26.4	-27.5	
35	29097.6	29504.5	29953.0	30411.3	30849.0	31238.3	31555.1	31780.8	31906.6	31935.8	31882.5	31765.0	35
	-1.8	-0.4	1.1	1.7	0.7	-2.2	-6.7	-12.0	-16.9	-20.4	-21.9	-21.2	
30	31969.1	32414.0	32905.0	33407.3	33888.0	34316.0	34660.9	34896.5	35006.0	34987.2	34852.2	34620.4	30
	-3.7	-2.0	0.0	1.0	0.3	-2.4	-6.6	-11.4	-15.4	-17.5	-17.1	-14.4	
25	34476.6	34949.3	35466.3	35991.9	36492.6	36935.4	37286.5	37514.5	37597.5	37529.8	37321.6	36992.8	25
	-4.7	-2.7	-0.5	0.8	0.1	-2.5	-6.5	-10.6	-13.6	-14.2	-12.2	-7.8	
20	36385.0	36891.8	37435.8	37981.6	38495.3	38943.1	39289.7	39502.4	39557.9	39449.8	39188.0	38792.5	20
	-4.1	-1.6	0.8	2.0	1.3	-1.4	-5.1	-8.7	-10.8	-10.4	-7.3	-2.0	
15	37458.2	38018.5	38606.3	39186.5	39724.8	40186.6	40537.0	40744.7	40788.9	40665.0	40383.8	39964.9	15
	-1.7	1.5	4.0	5.1	4.2	1.5	-1.9	-5.0	-6.5	-5.6	-2.4	2.5	
10	37517.0	38156.9	38814.5	39455.5	40045.1	40548.2	40930.9	41165.2	41234.7	41137.6	40885.2	40496.1	10
	1.9	5.9	8.6	9.6	8.6	6.2	3.2	0.7	-0.5	0.1	2.4	5.8	
5	36490.4	37235.3	37989.2	38720.1	39393.6	39974.7	40431.3	40738.9	40884.7	40868.4	40700.3	40396.7	5
	5.9	10.5	13.4	14.3	13.5	11.6	9.4	7.7	6.7	6.6	7.2	8.1	
0	34446.5	35313.1	36180.8	37021.8	37804.3	38495.4	39065.5	39492.9	39765.9	39882.8	39850.1	39680.3	0
	9.1	14.1	16.8	17.7	17.3	16.4	15.4	14.6	14.0	13.1	11.8	9.9	
Lat													Lat
E. Long	60	65	70	75	80	85	90	95	100	105	110	115	E. Long

NORTH COMPONENT (X) WMM-95

E. Long Lat	120	125	130	135	140	145	150	155	160	165	170	175	E. Long Lat
90	24.1 -18.6	-162.0 -17.8	-346.9 -16.9	-529.2 -15.8	-707.4 -14.6	-880.3 -13.3	-1046.4 -11.9	-1204.6 -10.4	-1353.6 -8.9	-1492.4 -7.3	-1619.7 -5.6	-1734.8 -3.8	90
85	1064.9 -17.6	1059.3 -17.5	1072.0 -17.4	1098.3 -17.2	1132.8 -17.0	1169.9 -16.6	1204.2 -16.1	1230.3 -15.5	1243.2 -14.7	1238.8 -13.6	1213.6 -12.5	1165.1 -11.0	85
80	2526.3 -19.4	2703.4 -20.0	2917.4 -20.7	3156.6 -21.3	3408.0 -21.9	3658.0 -22.4	3893.3 -22.8	4100.7 -22.9	4268.6 -22.7	4387.0 -22.2	4447.9 -21.3	4445.9 -20.0	80
75	4571.7 -23.5	4912.7 -24.6	5306.7 -25.8	5734.8 -27.1	6176.7 -28.3	6610.6 -29.4	7015.6 -30.3	7371.5 -30.9	7660.8 -31.2	7868.6 -30.9	7983.9 -30.0	7999.5 -28.5	75
70	7244.6 -28.5	7707.3 -30.0	8232.3 -31.6	8795.4 -33.1	9369.5 -34.6	9926.9 -35.8	10440.7 -36.8	10886.2 -37.4	11242.3 -37.5	11492.1 -37.0	11623.4 -35.8	11629.1 -33.9	70
65	10462.7 -33.4	10985.9 -35.1	11572.2 -36.7	12193.5 -38.0	12819.0 -39.1	13417.6 -39.9	13960.1 -40.2	14420.7 -40.1	14778.1 -39.5	15016.5 -38.3	15125.4 -36.5	15099.6 -34.0	65
60	14052.0 -37.1	14566.4 -38.7	15135.8 -39.9	15731.0 -40.5	16320.3 -40.7	16872.7 -40.3	17359.9 -39.4	17758.6 -37.9	18051.1 -36.0	18225.1 -33.7	18274.5 -30.9	18197.6 -27.8	60
55	17806.4 -38.6	18246.8 -39.9	18727.3 -40.3	19219.8 -39.9	19694.4 -38.7	20122.7 -36.8	20480.7 -34.2	20749.9 -31.0	20918.1 -27.5	20979.2 -23.8	20932.4 -20.0	20781.7 -16.3	55
50	21545.5 -37.4	21859.7 -38.0	22194.4 -37.4	22524.7 -35.8	22824.4 -33.2	23069.7 -29.8	23242.4 -25.7	23330.2 -21.0	23327.5 -16.0	23234.6 -11.1	23057.2 -6.4	22805.7 -2.3	50
45	25142.8 -33.4	25295.1 -32.9	25445.7 -31.2	25573.9 -28.6	25658.7 -25.1	25682.5 -20.8	25633.7 -15.9	25506.8 -10.4	25302.6 -4.7	25027.2 1.0	24692.8 6.1	24316.9 10.4	45
40	28516.2 -27.0	28487.8 -25.1	28433.6 -22.3	28338.6 -19.1	28188.0 -15.4	27971.4 -11.4	27684.8 -6.9	27329.7 -1.8	26912.7 3.6	26445.2 9.1	25944.9 14.2	25435.7 18.3	40
35	31597.7 -18.8	31385.6 -15.5	31124.0 -11.9	30803.7 -8.6	30417.2 -5.7	29962.3 -3.1	29443.3 -0.3	28868.8 3.0	28250.7 6.9	27605.2 11.2	26954.0 15.5	26326.0 19.3	35
30	34309.0 -10.2	33927.1 -5.5	33474.9 -1.5	32949.1 1.3	32349.7 2.6	31683.2 3.0	30962.0 3.1	30201.6 3.5	29419.1 4.9	28634.1 7.2	27871.2 10.3	27161.6 13.4	30
25	36562.6 -2.2	36042.7 3.3	35437.4 7.2	34749.4 9.0	33985.6 8.5	33160.2 6.3	32292.8 3.4	31404.6 0.7	30516.4 -0.9	29650.2 -1.0	28831.7 0.4	28091.2 2.8	25
20	38283.0 4.0	37673.4 9.4	36971.3 12.8	36184.6 13.4	35326.1 11.2	34415.9 6.9	33478.2 1.5	32537.5 -3.7	31616.5 -7.8	30737.5 -10.2	29924.8 -10.6	29205.0 -9.2	20
15	39428.0 7.8	38788.2 12.2	38056.7 14.5	37245.6 14.0	36372.4 10.8	35460.4 5.4	34535.3 -1.1	33621.9 -7.7	32742.1 -13.3	31916.0 -17.3	31164.1 -19.2	30506.6 -19.0	15
10	39989.7 9.2	39382.5 11.7	38689.2 12.4	37926.1 11.1	37113.7 7.7	36276.1 2.6	35437.6 -3.4	34620.5 -9.7	33843.3 -15.5	33121.9 -20.0	32470.7 -23.0	31901.9 -24.0	10
5	39976.4 8.7	39458.1 8.7	38860.6 7.8	38204.4 5.9	37511.6 3.1	36805.0 -0.5	36105.6 -4.6	35431.2 -9.1	34795.9 -13.7	34210.0 -17.9	33680.7 -21.4	33211.6 -23.6	5
0	39391.2 7.4	39004.2 4.8	38543.0 2.2	38032.1 0.0	37494.5 -1.7	36950.2 -3.1	36415.9 -4.6	35904.5 -6.5	35425.3 -9.0	34983.6 -12.2	34579.8 -15.6	34209.8 -18.9	0
Lat E. Long	120	125	130	135	140	145	150	155	160	165	170	175	Lat E. Long

NORTH COMPONENT (X) WMM-95

E. Long	180	185	190	195	200	205	210	215	220	225	230	235	E. Long
Lat													Lat
90	-1836.6	-1924.5	-1997.7	-2055.7	-2098.0	-2124.4	-2134.7	-2128.6	-2106.4	-2068.2	-2014.2	-1944.9	90
	-2.1	-0.3	1.5	3.2	5.0	6.7	8.3	9.9	11.4	12.8	14.2	15.4	
85	1092.1	994.3	872.8	729.5	567.8	391.6	206.0	16.5	-170.8	-349.8	-514.2	-657.7	85
	-9.4	-7.6	-5.6	-3.4	-1.1	1.3	3.8	6.4	8.9	11.4	13.8	16.1	
80	4377.9	4243.8	4045.7	3788.6	3479.4	3127.1	2742.2	2336.4	1922.2	1512.6	1120.4	758.0	80
	-18.3	-16.1	-13.5	-10.6	-7.3	-3.8	0.0	3.8	7.7	11.5	15.2	18.7	
75	7912.0	7722.2	7434.7	7057.5	6601.6	6080.4	5509.4	4905.5	4286.4	3670.2	3074.7	2517.2	75
	-26.4	-23.6	-20.2	-16.2	-11.8	-7.0	-1.9	3.2	8.3	13.3	18.0	22.3	
70	11507.1	11259.7	10893.7	10419.8	9851.5	9205.1	8499.0	7752.5	6986.1	6220.2	5475.3	4771.1	70
	-31.2	-27.7	-23.5	-18.6	-13.2	-7.4	-1.4	4.7	10.5	16.1	21.2	25.9	
65	14938.9	14647.8	14234.3	13709.9	13088.8	12387.2	11623.0	10815.0	9982.9	9146.4	8325.6	7540.2	65
	-30.7	-26.8	-22.1	-16.8	-11.0	-4.8	1.5	7.7	13.5	18.9	23.6	27.7	
60	17997.6	17680.5	17255.4	16733.1	16125.5	15445.9	14708.3	13927.5	13118.9	12298.7	11483.3	10690.1	60
	-24.2	-20.2	-15.7	-10.8	-5.5	0.1	5.7	11.1	16.1	20.4	24.0	26.7	
55	20534.4	20199.8	19787.8	19307.7	18767.8	18175.7	17538.4	16863.3	16158.9	15434.6	14701.3	13971.8	55
	-12.7	-9.1	-5.6	-1.9	2.0	6.0	10.0	13.8	17.2	19.8	21.6	22.6	
50	22493.6	22134.9	21742.0	21323.2	20882.3	20419.2	19931.8	19417.5	18875.6	18307.4	17716.8	17110.4	50
	1.1	3.8	6.0	7.9	9.7	11.5	13.3	14.9	16.2	16.8	16.6	15.6	
45	23920.2	23523.2	23142.0	22784.8	22450.8	22131.5	21814.0	21485.4	21134.8	20755.4	20343.8	19900.1	45
	13.4	15.3	16.1	16.2	15.8	15.3	14.7	14.1	13.1	11.7	9.6	7.0	
40	24945.6	24501.5	24123.4	23819.3	23583.4	23399.2	23244.1	23095.6	22934.5	22747.0	22523.5	22257.9	40
	21.1	22.4	22.3	21.1	19.1	16.7	14.1	11.5	8.6	5.4	1.8	-2.2	
35	25754.2	25269.7	24894.0	24633.5	24477.8	24403.4	24381.0	24381.8	24382.0	24363.5	24312.3	24216.8	35
	22.0	23.3	23.1	21.6	19.0	15.6	11.8	7.6	3.2	-1.4	-6.2	-11.0	
30	26539.6	26036.2	25671.0	25446.3	25347.2	25346.6	25412.3	25514.8	25629.7	25738.3	25823.8	25869.8	30
	16.2	18.1	18.7	17.9	15.8	12.4	8.1	3.1	-2.4	-8.0	-13.6	-18.8	
25	27460.4	26965.5	26620.3	26421.8	26351.7	26382.5	26484.6	26632.5	26805.6	26987.0	27159.1	27302.0	25
	5.6	8.3	10.2	10.9	10.1	7.7	3.6	-1.7	-7.8	-14.1	-20.1	-25.4	
20	28603.6	28138.8	27816.8	27629.2	27556.7	27575.0	27661.3	27797.2	27968.8	28162.7	28362.3	28545.5	20
	-6.5	-3.2	0.0	2.3	3.1	1.9	-1.4	-6.5	-12.9	-19.6	-25.9	-31.0	
15	29960.7	29535.6	29230.2	29032.8	28925.9	28891.5	28915.0	28987.1	29100.5	29246.5	29411.2	29573.7	15
	-16.9	-13.6	-9.7	-6.3	-4.2	-4.2	-6.7	-11.5	-17.7	-24.5	-30.7	-35.5	
10	31423.5	31036.5	30734.7	30506.2	30338.1	30219.6	30145.2	30112.8	30121.4	30167.4	30241.3	30327.0	10
	-23.1	-20.5	-17.0	-13.5	-11.1	-10.5	-12.3	-16.5	-22.3	-28.7	-34.4	-38.6	
5	32801.9	32446.3	32136.0	31861.9	31616.9	31398.3	31207.4	31048.2	30924.3	30836.6	30782.0	30752.0	5
	-24.2	-23.4	-21.4	-18.9	-17.0	-16.5	-18.0	-21.5	-26.4	-31.8	-36.7	-40.0	
0	33865.2	33536.0	33213.2	32891.6	32570.9	32255.2	31951.6	31667.4	31409.4	31182.6	30990.1	30832.1	0
	-21.3	-22.7	-23.0	-22.6	-22.1	-22.2	-23.5	-26.2	-29.8	-33.8	-37.3	-39.6	
Lat													Lat
E. Long	180	185	190	195	200	205	210	215	220	225	230	235	E. Long

NORTH COMPONENT (X) WMM-95

E. Long	240	245	250	255	260	265	270	275	280	285	290	295	E. Long
Lat													Lat
90	-1860.8	-1762.5	-1650.8	-1526.5	-1390.6	-1244.2	-1088.2	-924.0	-752.8	-575.8	-394.5	-210.1	90
	16.5	17.5	18.3	19.0	19.6	20.0	20.3	20.4	20.3	20.1	19.7	19.2	
85	-774.8	-860.2	-909.5	-919.1	-886.5	-810.2	-689.8	-526.2	-321.2	-77.7	200.2	507.8	85
	18.3	20.2	21.9	23.3	24.5	25.3	25.8	26.0	25.9	25.5	24.8	23.8	
80	436.9	167.8	-40.6	-180.7	-247.5	-237.6	-150.1	13.7	250.4	554.6	919.0	1334.6	80
	21.9	24.8	27.3	29.5	31.2	32.5	33.3	33.6	33.5	32.9	31.9	30.5	
75	2013.8	1579.4	1226.7	966.4	806.3	751.5	803.8	961.5	1219.8	1570.6	2003.0	2503.7	75
	26.3	29.9	33.0	35.6	37.8	39.5	40.6	41.3	41.3	40.8	39.8	38.2	
70	4126.7	3559.6	3085.9	2719.5	2471.5	2349.6	2357.6	2494.6	2755.2	3129.5	3603.4	4159.2	70
	30.0	33.6	36.8	39.6	42.1	44.1	45.7	46.9	47.4	47.4	46.7	45.2	
65	6809.7	6153.4	5589.7	5135.8	4806.6	4613.9	4565.1	4661.8	4899.9	5268.8	5752.1	6328.6	65
	31.2	34.3	37.0	39.6	42.0	44.4	46.7	48.7	50.2	51.1	51.1	50.3	
60	9937.0	9243.1	8628.1	8112.3	7714.8	7452.3	7337.3	7375.9	7567.0	7901.4	8362.1	8925.8	60
	28.9	30.8	32.5	34.5	36.9	39.7	42.8	46.0	48.9	51.1	52.4	52.6	
55	13260.5	12584.5	11963.8	11420.3	10977.0	10655.8	10474.7	10445.6	10572.2	10848.8	11260.3	11783.6	55
	23.0	23.2	23.7	24.9	27.0	30.2	34.2	38.8	43.4	47.4	50.4	52.0	
50	16498.0	15893.1	15313.9	14782.8	14325.3	13967.3	13731.9	13637.0	13691.9	13896.6	14240.4	14703.5	50
	14.2	12.8	11.9	12.2	13.9	17.3	22.2	28.2	34.5	40.5	45.5	48.9	
45	19428.3	18937.1	18441.3	17961.8	17524.4	17157.3	16887.3	16737.2	16722.2	16848.9	17113.6	17502.7	45
	4.0	1.2	-0.9	-1.5	-0.3	3.2	8.6	15.7	23.6	31.5	38.5	44.2	
40	21948.0	21596.3	21212.4	20813.7	20424.2	20072.3	19786.8	19593.8	19513.8	19560.2	19737.8	20041.8	40
	-6.3	-10.1	-12.9	-14.3	-13.5	-10.4	-4.9	2.7	11.7	21.2	30.2	38.2	
35	24067.9	23861.0	23598.8	23293.1	22964.5	22639.9	22348.5	22118.7	21975.7	21939.0	22022.1	22230.6	35
	-15.6	-19.7	-22.9	-24.7	-24.5	-22.0	-17.0	-9.6	-0.3	10.2	21.0	31.1	
30	25860.5	25783.0	25632.2	25412.9	25140.7	24839.6	24539.0	24269.2	24059.4	23935.2	23917.9	24023.0	30
	-23.4	-27.4	-30.4	-32.3	-32.6	-30.9	-27.0	-20.5	-11.7	-1.0	10.7	22.5	
25	27393.3	27412.7	27346.5	27191.8	26958.0	26665.8	26343.9	26025.1	25742.7	25528.1	25408.8	25408.6	25
	-29.8	-33.1	-35.5	-37.1	-37.7	-37.0	-34.6	-29.7	-22.3	-12.4	-0.6	12.1	
20	28686.2	28758.1	28740.2	28621.7	28405.0	28106.0	27752.2	27378.4	27022.4	26720.6	26505.2	26404.7	20
	-34.7	-37.2	-38.7	-39.7	-40.5	-40.7	-39.9	-37.2	-31.9	-23.8	-13.1	-0.7	
15	29707.4	29783.7	29776.9	29669.2	29454.8	29142.9	28757.5	28334.0	27913.4	27535.9	27236.6	27045.1	15
	-38.5	-39.9	-40.4	-40.8	-41.5	-42.4	-43.2	-42.8	-40.2	-34.7	-26.2	-15.4	
10	30402.1	30440.4	30414.5	30301.0	30085.4	29767.9	29365.4	28910.1	28443	28007.2	27637.3	27361.5	10
	-40.8	-41.3	-41.0	-40.6	-41.1	-42.6	-44.7	-46.5	-46.8	-44.5	-39.2	-31.1	
5	30732.6	30703.3	30638.8	30511.8	30299.7	29991.6	29593.9	29131.0	28639.9	28160.9	27728.7	27367.8	5
	-41.5	-41.3	-40.3	-39.5	-39.8	-41.6	-44.7	-48.2	-51.1	-52.1	-50.5	-46.2	
0	30704.2	30594.0	30480.6	30336.0	30130.8	29843.5	29467.9	29016.6	28517.4	28004.9	27511.0	27057.5	0
	-40.4	-39.8	-38.6	-37.6	-37.8	-39.7	-43.3	-48.0	-52.8	-56.8	-58.8	-58.6	
Lat													Lat
E. Long	240	245	250	255	260	265	270	275	280	285	290	295	E. Long

NORTH COMPONENT (X) WMM-95

E. Long	300	305	310	315	320	325	330	335	340	345	350	355	E. Long
Lat													Lat
90	-24.1 18.6	162.0 17.8	346.9 16.9	529.2 15.8	707.4 14.6	880.3 13.3	1046.4 11.9	1204.6 10.4	1353.6 8.9	1492.4 7.3	1619.7 5.6	1734.8 3.8	90
85	839.5 22.5	1189.3 21.0	1550.6 19.3	1916.7 17.3	2280.7 15.3	2636.0 13.1	2975.9 10.9	3294.4 8.6	3586.1 6.3	3845.8 4.0	4069.3 1.8	4253.4 -0.4	85
80	1791.5 28.7	2278.6 26.6	2784.7 24.1	3298.0 21.5	3807.4 18.6	4302.1 15.7	4772.1 12.7	5208.5 9.6	5603.5 6.7	5950.3 3.8	6243.7 1.0	6479.5 -1.6	80
75	3057.9 36.1	3649.6 33.5	4262.4 30.5	4880.5 27.2	5488.7 23.7	6073.4 20.1	6622.6 16.5	7126.1 12.8	7575.7 9.3	7965.2 5.9	8290.1 2.6	8547.6 -0.4	75
70	4777.0 43.1	5435.9 40.3	6114.6 37.0	6793.1 33.4	7453.1 29.4	8079.0 25.3	8658.0 21.2	9179.8 17.1	9637.6 13.1	10026.5 9.3	10344.4 5.7	10591.0 2.3	70
65	6973.7 48.5	7661.6 45.9	8366.4 42.6	9064.5 38.8	9735.0 34.7	10361.2 30.4	10930.1 26.1	11432.5 21.8	11862.9 17.6	12218.9 13.5	12500.7 9.6	12710.9 5.8	65
60	9564.4 51.5	10247.7 49.5	10946.2 46.5	11632.8 43.0	12284.8 39.1	12884.5 35.1	13419.4 30.9	13881.5 26.8	14266.6 22.5	14573.9 18.2	14805.5 13.8	14966.6 9.5	60
55	12389.0 52.1	13043.8 51.0	13715.4 48.9	14373.8 46.0	14994.6 42.8	15559.4 39.3	16055.8 35.7	16476.6 31.9	16818.1 27.7	17079.9 23.2	17264.9 18.3	17379.4 13.3	55
50	15257.7 50.8	15869.9 51.0	16506.0 50.1	17134.0 48.3	17727.4 46.1	18266.7 43.5	18739.0 40.6	19136.4 37.2	19454.8 33.1	19692.7 28.3	19851.7 22.8	19938.3 17.0	50
45	17993.3 48.0	18555.2 50.2	19155.0 50.9	19760.0 50.5	20341.7 49.4	20878.4 47.8	21355.1 45.5	21761.8 42.4	22091.8 38.3	22341.0 33.1	22508.6 27.0	22599.6 20.4	45
40	20457.9 44.4	20962.9 48.8	21527.6 51.4	22120.3 52.6	22711.0 52.7	23274.5 51.8	23791.2 49.9	24246.3 46.8	24628.7 42.4	24930.0 36.8	25146.1 30.1	25280.2 23.1	40
35	22561.4 39.7	23001.7 46.5	23530.3 51.3	24119.1 54.1	24737.3 55.2	25354.6 54.7	25943.8 52.8	26482.4 49.4	26952.1 44.6	27339.7 38.5	27638.3 31.7	27849.9 24.7	35
30	24259.3 33.4	24626.6 42.4	25114.0 49.2	25700.0 53.5	26353.7 55.4	27038.6 55.2	27717.4 53.0	28356.9 49.1	28930.5 43.9	29420.4 37.7	29818.5 31.2	30127.3 24.9	30
25	25546.0 24.4	25832.4 35.3	26268.2 43.7	26839.4 49.3	27516.3 51.9	28256.7 51.7	29012.9 49.3	29740.7 45.2	30406.0 40.0	30988.2 34.2	31480.6 28.5	31887.8 23.5	25
20	26443.6 12.2	26640.8 23.9	27005.4 33.5	27530.6 39.9	28189.6 43.1	28937.6 43.3	29720.5 41.1	30487.0 37.3	31199.3 32.7	31837.6 28.0	32398.6 23.8	32889.8 20.5	20
15	26986.4 -3.4	27081.2 8.2	27342.6 17.9	27769.0 25.0	28338.9 28.8	29011.0 29.7	29733.2 28.3	30455.8 25.6	31144.0 22.5	31782.6 19.6	32372.9 17.3	32923.2 15.9	15
10	27201.0 -21.4	27172.6 -11.2	27288.0 -2.0	27548.6 5.0	27940.6 9.5	28434.0 11.6	28989.2 11.8	29569.1 11.0	30150.0 9.9	30724.5 9.3	31297.3 9.1	31873.6 9.2	10
5	27093.7 -39.7	26916.3 -32.1	26842.3 -24.5	26874.2 -17.9	27007.6 -12.9	27229.8 -9.5	27523.2 -7.3	27872.2 -5.8	28269.8 -4.4	28718.1 -2.8	29222.3 -1.1	29780.5 0.3	5
0	26655.2 -56.0	26307.7 -51.7	26016.2 -46.5	25783.5 -41.0	25614.5 -35.9	25515.8 -31.4	25494.7 -27.4	25560.5 -23.6	25724.0 -20.0	25995.3 -16.4	26377.5 -13.3	26859.5 -11.3	0
Lat													Lat
E. Long	300	305	310	315	320	325	330	335	340	345	350	355	E. Long

NORTH COMPONENT (X) WMM-95

Lat \ E. Long	0	5	10	15	20	25	30	35	40	45	50	55	Lat
0	27412.5 -10.8	27993.7 -12.3	28558.6 -15.6	29075.7 -20.0	29538.7 -24.4	29967.9 -27.7	30401.8 -28.7	30881.7 -26.8	31437.9 -21.8	32082.3 -14.6	32810.0 -6.2	33604.8 2.1	0
-5	23899.9 -25.0	24379.0 -26.6	24861.6 -30.0	25321.6 -34.1	25760.4 -37.7	26206.2 -39.3	26701.8 -38.0	27286.7 -33.2	27981.8 -25.4	28783.9 -15.7	29671.7 -5.4	30616.8 3.8	-5
-10	20255.9 -40.5	20557.0 -41.6	20889.5 -43.8	21240.0 -46.3	21620.2 -47.6	22063.0 -46.7	22609.6 -42.7	23290.8 -35.4	24113.2 -25.6	25057.0 -14.7	26085.2 -4.2	27158.7 4.5	-10
-15	16876.7 -55.7	16958.1 -55.1	17104.5 -55.0	17319.6 -54.5	17624.7 -52.7	18053.2 -48.6	18637.4 -42.0	19393.5 -32.9	20310.8 -22.4	21353.5 -11.9	22472.6 -2.7	23621.2 4.0	-15
-20	14056.2 -68.2	13930.9 -65.3	13905.8 -62.0	14000.0 -58.0	14240.5 -52.5	14655.3 -45.5	15262.2 -36.8	16058.9 -27.1	17017.6 -17.3	18090.3 -8.5	19221.4 -2.0	20362.8 1.8	-20
-25	11952.0 -76.0	11686.1 -70.5	11551.2 -64.1	11575.2 -56.6	11784.0 -48.1	12194.5 -38.9	12806.9 -29.4	13600.1 -20.2	14532.4 -12.2	15549.7 -6.3	16597.5 -3.1	17633.5 -2.5	-25
-30	10607.5 -77.6	10293.1 -70.0	10130.7 -61.1	10147.9 -51.4	10362.5 -41.2	10776.1 -31.3	11371.1 -22.3	12111.1 -14.8	12946.4 -9.5	13823.6 -6.9	14696.3 -6.9	15534.1 -9.2	-30
-35	10001.8 -72.9	9719.3 -64.1	9596.4 -54.2	9652.3 -43.8	9891.2 -33.8	10299.4 -24.9	10844.5 -17.7	11480.5 -12.8	12156.4 -10.6	12825.2 -11.1	13453.4 -13.8	14025.1 -18.2	-35
-40	10090.5 -62.9	9879.2 -54.1	9820.6 -44.8	9920.3 -35.6	10168.9 -27.4	10539.5 -20.9	10991.0 -16.6	11474.6 -14.9	11943.1 -15.6	12360.1 -18.5	12705.4 -23.0	12977.0 -28.3	-40
-45	10808.8 -49.6	10660.4 -42.0	10643.8 -34.5	10751.8 -27.9	10963.6 -22.8	11245.1 -19.6	11552.8 -18.5	11841.1 -19.8	12070.7 -22.9	12215.9 -27.5	12268.0 -32.8	12235.1 -38.1	-45
-50	12045.1 -35.6	11918.4 -29.8	11892.3 -24.9	11950.0 -21.4	12064.7 -19.6	12200.9 -19.6	12318.4 -21.6	12379.0 -25.2	12352.8 -30.0	12223.4 -35.3	11990.0 -40.6	11665.9 -45.2	-50
-55	13615.8 -23.1	13461.7 -19.2	13371.0 -16.8	13322.2 -16.0	13287.7 -16.9	13235.3 -19.5	13131.8 -23.5	12947.9 -28.5	12662.8 -34.0	12267.4 -39.5	11765.3 -44.3	11171.3 -48.0	-55
-60	15271.9 -13.2	15053.2 -10.9	14859.0 -10.2	14667.9 -11.2	14455.2 -13.8	14194.7 -17.7	13861.4 -22.5	13434.9 -27.9	12902.1 -33.3	12258.8 -38.3	11510.8 -42.4	10672.4 -45.4	-60
-65	16741.5 -6.2	16438.9 -4.8	16124.1 -5.0	15778.9 -6.6	15383.7 -9.5	14919.2 -13.4	14368.4 -18.0	13718.4 -22.8	12962.0 -27.5	12098.8 -31.7	11135.6 -35.2	10085.7 -37.7	-65
-70	17780.0 -1.1	17388.3 -0.1	16951.9 -0.4	16457.6 -1.8	15892.0 -4.1	15242.9 -7.2	14500.2 -10.7	13657.2 -14.5	12711.4 -18.2	11665.4 -21.5	10526.7 -24.4	9307.9 -26.8	-70
-75	18198.6 3.2	17719.1 4.0	17167.6 3.9	16537.0 3.1	15820.3 1.7	15012.0 -0.3	14108.1 -2.7	13107.3 -5.3	12011.2 -7.9	10825.0 -10.6	9557.0 -13.0	8219.3 -15.3	-75
-80	17860.7 7.6	17296.4 8.0	16639.6 8.0	15888.9 7.6	15043.4 6.8	14103.6 5.6	13071.0 4.1	11949.1 2.3	10743.1 0.4	9460.4 -1.7	8110.5 -3.8	6704.7 -6.0	-80
-85	16667.4 12.1	16023.3 11.9	15274.6 11.6	14424.7 11.0	13477.7 10.2	12438.8 9.1	11314.0 7.9	10110.3 6.5	8835.8 4.9	7499.7 3.1	6112.2 1.2	4684.3 -0.8	-85
-90	14562.4 16.1	13846.7 15.1	13025.6 14.0	12105.4 12.8	11093.1 11.4	9996.3 10.0	8823.5 8.5	7583.5 6.9	6285.7 5.3	4940.2 3.6	3557.0 2.0	2146.8 0.2	-90
Lat \ E. Long	0	5	10	15	20	25	30	35	40	45	50	55	Lat

NORTH COMPONENT (X) WMM-95

E. Long / Lat	60	65	70	75	80	85	90	95	100	105	110	115	E. Long / Lat
0	34446.5 9.1	35313.1 14.1	36180.8 16.8	37021.8 17.7	37804.3 17.3	38495.4 16.4	39065.5 15.4	39492.9 14.6	39765.9 14.0	39882.8 13.1	39850.1 11.8	39680.3 9.9	0
-5	31593.6 10.9	32581.5 15.4	33562.0 17.7	34513.4 18.6	35409.8 18.8	36222.8 19.1	36926.8 19.7	37502.1 20.2	37936.0 20.1	38221.9 18.8	38359.6 16.0	38355.9 11.7	-5
-10	28246.9 10.5	29330.7 13.9	30397.2 15.4	31432.5 16.1	32418.8 17.0	33335.7 18.6	34163.3 20.9	34884.1 23.0	35483.2 24.0	35947.1 22.9	36266.5 19.3	36440.8 13.7	-10
-15	24766.7 7.9	25892.1 9.5	26990.1 9.8	28055.1 10.2	29079.3 11.7	30052.0 14.6	30960.8 18.5	31792.1 22.3	32528.8 24.7	33150.6 24.5	33638.5 21.3	33982.6 15.6	-15
-20	21483.8 3.0	22571.4 2.5	23624.2 1.5	24644.9 1.5	25635.1 3.4	26594.4 7.3	27519.5 12.6	28401.6 18.0	29223.3 21.9	29959.3 23.2	30581.7 21.4	31070.5 17.0	-20
-25	18634.0 -4.0	19592.8 -6.5	20515.0 -8.6	21410.4 -9.0	22289.0 -6.8	23159.6 -2.3	24027.2 4.0	24888.8 10.5	25729.1 15.9	26520.4 18.9	27228.4 19.2	27823.6 17.0	-25
-30	16324.6 -12.9	17070.8 -16.8	17784.7 -19.5	18482.3 -20.0	19180.1 -17.7	19893.5 -12.8	20634.2 -6.2	21404.8 1.0	22193.7 7.4	22974.1 12.1	23708.9 14.6	24361.9 14.9	-30
-35	14541.1 -23.1	15014.4 -27.5	15464.0 -30.2	15910.8 -30.5	16375.7 -28.0	16878.2 -23.1	17434.5 -16.5	18051.7 -9.2	18722.9 -2.3	19425.0 3.5	20122.7 7.7	20777.5 10.3	-35
-40	13187.4 -33.5	13358.1 -37.4	13514.0 -39.5	13679.7 -39.3	13878.8 -36.7	14133.1 -31.9	14461.2 -25.7	14873.8 -18.9	15368.9 -12.0	15929.7 -5.9	16526.6 -0.7	17123.8 3.4	-40
-45	12137.4 -42.5	12002.0 -45.5	11857.3 -46.6	11730.6 -45.7	11647.0 -42.9	11629.9 -38.4	11699.0 -32.9	11867.8 -26.9	12139.9 -20.8	12506.0 -15.0	12944.9 -9.7	13428.5 -5.0	-45
-50	11274.9 -48.6	10845.6 -50.5	10407.8 -50.6	9990.2 -49.1	9619.1 -46.2	9318.7 -42.2	9110.5 -37.6	9010.6 -32.6	9027.6 -27.6	9160.3 -22.7	9397.6 -18.1	9720.6 -13.8	-50
-55	10508.7 -50.4	9805.3 -51.3	9090.5 -50.7	8393.0 -49.0	7740.1 -46.3	7157.4 -43.0	6667.8 -39.4	6290.3 -35.7	6038.3 -32.1	5917.7 -28.5	5926.5 -25.0	6055.7 -21.7	-55
-60	9764.8 -47.1	8813.6 -47.6	7846.3 -46.9	6891.2 -45.5	5976.2 -43.4	5127.5 -41.1	4369.9 -38.7	3724.8 -36.3	3209.2 -34.1	2834.5 -32.0	2605.9 -29.8	2522.3 -27.7	-60
-65	8967.9 -39.2	7805.1 -39.9	6622.7 -39.7	5447.7 -39.1	4307.4 -38.0	3228.2 -36.9	2235.5 -35.8	1352.0 -34.8	596.8 -33.9	-15.1 -33.1	-474.1 -32.3	-775.9 -31.4	-65
-70	8025.7 -28.5	6700.4 -29.7	5354.9 -30.4	4013.9 -30.8	2702.7 -31.0	1446.5 -31.2	269.6 -31.4	-805.7 -31.6	-1759.9 -31.9	-2577.0 -32.3	-3244.9 -32.5	-3756.4 -32.7	-70
-75	6826.9 -17.3	5397.5 -19.1	3950.8 -20.7	2508.4 -22.2	1092.1 -23.5	-275.7 -24.8	-1573.8 -26.1	-2781.9 -27.4	-3882.1 -28.6	-4858.9 -29.8	-5700.0 -30.9	-6396.3 -31.8	-75
-80	5256.7 -8.2	3781.4 -10.4	2295.3 -12.5	815.7 -14.7	-639.4 -16.7	-2052.3 -18.7	-3405.5 -20.7	-4682.4 -22.6	-5867.6 -24.4	-6947.8 -26.1	-7911.3 -27.6	-8748.7 -28.9	-80
-85	3228.1 -2.8	1756.1 -5.0	281.7 -7.1	-1181.8 -9.3	-2620.5 -11.5	-4021.0 -13.6	-5369.7 -15.6	-6654.1 -17.6	-7862.1 -19.4	-8982.5 -21.1	-10005.2 -22.6	-10921.5 -23.9	-85
-90	720.3 -1.5	-711.8 -3.1	-2138.4 -4.8	-3548.8 -6.4	-4932.1 -8.0	-6277.9 -9.6	-7575.9 -11.0	-8816.3 -12.4	-9989.6 -13.6	-11086.8 -14.8	-12099.7 -15.9	-13020.5 -16.8	-90
Lat / E. Long	60	65	70	75	80	85	90	95	100	105	110	115	Lat / E. Long

NORTH COMPONENT (X) WMM-95

E. Long	120	125	130	135	140	145	150	155	160	165	170	175	E. Long
Lat 0	39391.2 7.4	39004.2 4.8	38543.0 2.2	38032.1 0.0	37494.5 -1.7	36950.2 -3.1	36415.9 -4.6	35904.5 -6.5	35425.3 -9.0	34983.6 -12.2	34579.8 -15.6	34209.8 -18.9	Lat 0
-5	38226.7 6.6	37996.0 1.6	37692.2 -2.3	37343.6 -4.7	36973.4 -5.3	36598.7 -4.7	36231.5 -3.6	35880.5 -2.9	35551.2 -3.3	35245.3 -5.2	34958.4 -8.4	34680.5 -12.5	-5
-10	36482.1 7.0	36415.4 0.5	36272.5 -4.3	36084.4 -6.8	35874.7 -6.8	35658.3 -4.8	35443.4 -2.0	35235.6 0.4	35038.2 1.4	34851.0 0.5	34667.4 -2.5	34473.9 -7.1	-10
-15	34188.7 8.7	34279.4 1.9	34287.2 -3.2	34244.5 -5.8	34175.7 -5.7	34094.8 -3.5	34008.5 -0.3	33920.7 2.5	33834.1 3.9	33748.1 3.2	33655.8 0.3	33543.0 -4.6	-15
-20	31422.5 11.1	31653.8 5.2	31793.9 0.5	31874.5 -2.1	31921.2 -2.4	31949.0 -1.0	31965.8 1.2	31975.8 3.1	31982.0 3.7	31984.4 2.5	31976.9 -0.6	31946.2 -5.5	-20
-25	28292.2 13.2	28640.6 9.0	28891.0 5.3	29072.6 3.0	29211.0 2.0	29324.4 2.1	29423.3 2.5	29514.3 2.6	29601.6 1.7	29686.1 -0.5	29762.7 -4.1	29819.7 -8.9	-25
-30	24909.3 13.7	25346.2 11.6	25685.3 9.4	25949.8 7.6	26164.5 6.1	26349.6 4.8	26519.5 3.4	26683.6 1.6	26847.9 -0.9	27013.9 -4.2	27177.6 -8.2	27328.9 -12.9	-30
-35	21358.7 11.5	21851.5 11.6	22258.1 11.1	22593.8 10.1	22879.3 8.6	23134.8 6.5	23376.6 3.9	23616.5 0.7	23861.4 -3.0	24113.4 -7.0	24369.0 -11.3	24619.4 -15.7	-35
-40	17689.1 6.4	18201.3 8.3	18653.4 9.3	19051.3 9.3	19408.9 8.3	19742.5 6.3	20067.0 3.4	20393.7 -0.1	20729.2 -4.1	21075.2 -8.2	21428.3 -12.2	21780.6 -16.2	-40
-45	13927.6 -1.1	14419.3 1.9	14890.4 4.1	15338.0 5.1	15766.9 5.1	16186.1 3.8	16605.1 1.7	17031.4 -1.2	17468.9 -4.5	17917.8 -7.9	18373.8 -11.3	18829.1 -14.6	-45
-50	10107.3 -9.9	10536.8 -6.5	10993.2 -3.8	11466.8 -1.9	11953.6 -1.0	12453.3 -1.0	12967.5 -1.9	13497.0 -3.4	14041.0 -5.3	14596.0 -7.5	15156.2 -9.7	15713.0 -12.0	-50
-55	6291.1 -18.4	6616.7 -15.4	7016.8 -12.7	7477.8 -10.4	7989.0 -8.7	8542.0 -7.6	9129.6 -7.1	9745.5 -7.1	10382.6 -7.5	11033.2 -8.2	11688.5 -9.1	12338.8 -10.2	-55
-60	2576.8 -25.5	2758.9 -23.3	3055.3 -21.1	3451.7 -18.9	3934.1 -17.0	4488.4 -15.2	5101.6 -13.7	5760.8 -12.5	6453.9 -11.5	7168.8 -10.9	7893.8 -10.5	8617.8 -10.4	-60
-65	-921.5 -30.4	-916.6 -29.1	-770.8 -27.7	-496.4 -26.1	-107.7 -24.3	380.0 -22.4	950.8 -20.6	1589.2 -18.7	2279.7 -17.0	3007.9 -15.3	3760.3 -13.9	4524.8 -12.8	-65
-70	-4108.3 -32.7	-4302.3 -32.4	-4343.7 -31.8	-4241.4 -30.8	-4006.7 -29.6	-3653.1 -28.1	-3195.2 -26.4	-2647.9 -24.5	-2026.4 -22.4	-1344.9 -20.4	-616.8 -18.4	146.0 -16.4	-70
-75	-6942.4 -32.5	-7336.3 -32.9	-7579.5 -33.0	-7676.2 -32.7	-7633.6 -32.1	-7460.5 -31.1	-7167.4 -29.8	-6765.9 -28.2	-6267.8 -26.4	-5684.7 -24.3	-5027.9 -22.1	-4307.6 -19.9	-75
-80	-9453.1 -30.0	-10020.0 -30.8	-10447.1 -31.2	-10734.4 -31.4	-10884.1 -31.2	-10899.8 -30.7	-10786.9 -29.9	-10551.8 -28.7	-10201.7 -27.3	-9744.2 -25.6	-9187.0 -23.6	-8538.1 -21.5	-80
-85	-11723.8 -25.0	-12406.0 -25.9	-12963.5 -26.5	-13392.8 -26.9	-13692.1 -27.0	-13860.8 -26.8	-13899.5 -26.4	-13810.0 -25.6	-13594.9 -24.7	-13258.1 -23.5	-12803.8 -22.1	-12237.4 -20.5	-85
-90 Lat	-13842.2 -17.6	-14558.5 -18.3	-15164.0 -18.8	-15654.2 -19.2	-16025.2 -19.4	-16274.2 -19.5	-16399.4 -19.5	-16399.8 -19.3	-16275.3 -18.9	-16027.0 -18.4	-15656.7 -17.8	-15167.3 -17.0	-90 Lat
E. Long	120	125	130	135	140	145	150	155	160	165	170	175	E. Long

NORTH COMPONENT (X) WMM-95

E. Long	180	185	190	195	200	205	210	215	220	225	230	235	E. Long
Lat													Lat
0	33865.2 -21.3	33536.0 -22.7	33213.2 -23.0	32891.6 -22.6	32570.9 -22.1	32255.2 -22.2	31951.6 -23.5	31667.4 -26.2	31409.4 -29.8	31182.6 -33.8	30990.1 -37.3	30832.1 -39.6	0
-5	34397.6 -16.6	34096.7 -20.3	33769.3 -23.1	33414.5 -25.0	33037.8 -26.3	32649.4 -27.4	32260.0 -28.6	31879.4 -30.3	31515.4 -32.4	31175.2 -34.6	30866.4 -36.4	30596.0 -37.5	-5
-10	34253.6 -12.5	33991.3 -18.0	33679.6 -23.0	33320.7 -27.0	32924.8 -30.0	32506.2 -31.9	32078.4 -33.2	31651.8 -33.9	31233.7 -34.3	30830.6 -34.5	30450.7 -34.6	30103.6 -34.6	-10
-15	33391.5 -10.7	33186.0 -17.3	32919.3 -23.7	32595.5 -29.1	32227.6 -33.3	31832.2 -35.9	31424.0 -36.9	31012.4 -36.8	30602.0 -35.7	30195.8 -34.2	29798.6 -32.9	29417.8 -31.9	-15
-20	31875.0 -11.7	31748.2 -18.6	31559.0 -25.4	31311.8 -31.5	31020.0 -36.2	30700.3 -39.1	30366.5 -40.0	30025.5 -39.2	29677.7 -37.2	29320.6 -34.6	28952.7 -32.2	28577.0 -30.6	-20
-25	29841.6 -14.8	29814.2 -21.3	29730.7 -27.8	29594.5 -33.7	29416.9 -38.4	29212.4 -41.4	28991.7 -42.4	28758.3 -41.4	28508.1 -39.0	28233.0 -36.0	27925.6 -33.2	27583.7 -31.3	-25
-30	27454.0 -18.3	27540.0 -24.0	27579.7 -29.7	27574.0 -35.2	27530.8 -39.6	27460.0 -42.7	27368.3 -43.8	27255.5 -43.2	27114.4 -41.2	26933.8 -38.4	26703.0 -35.7	26417.0 -33.9	-30
-35	24852.4 -20.4	25056.2 -25.3	25222.8 -30.3	25350.3 -35.1	25441.8 -39.3	25502.3 -42.5	25534.4 -44.1	25535.8 -44.2	25498.7 -43.0	25412.4 -41.0	25267.0 -38.8	25057.9 -37.2	-35
-40	22121.1 -20.2	22438.8 -24.4	22724.8 -28.7	22974.6 -33.1	23187.1 -37.1	23363.3 -40.5	23503.2 -42.8	23604.6 -43.7	23662.0 -43.5	23668.8 -42.3	23619.3 -40.8	23511.9 -39.5	-40
-45	19273.7 -17.9	19697.1 -21.4	20090.2 -25.2	20446.6 -29.1	20762.9 -33.1	21037.9 -36.5	21271.6 -39.2	21463.7 -40.9	21613.5 -41.5	21720.2 -41.1	21784.0 -40.1	21807.1 -38.9	-45
-50	16256.9 -14.5	16778.0 -17.4	17267.4 -20.5	17718.6 -24.0	18127.8 -27.5	18494.3 -30.8	18819.3 -33.5	19106.3 -35.4	19359.5 -36.3	19584.0 -36.3	19785.1 -35.6	19968.3 -34.5	-50
-55	12974.3 -11.7	13585.8 -13.6	14165.5 -15.9	14707.9 -18.5	15210.5 -21.2	15674.1 -23.8	16102.7 -26.0	16502.7 -27.6	16882.4 -28.3	17250.4 -28.3	17615.2 -27.6	17983.4 -26.5	-55
-60	9330.7 -10.7	10023.7 -11.4	10690.2 -12.5	11326.5 -13.9	11931.6 -15.4	12508.2 -16.8	13061.9 -17.9	13600.8 -18.6	14134.3 -18.7	14672.2 -18.3	15222.8 -17.5	15791.7 -16.4	-60
-65	5291.1 -11.9	6050.9 -11.3	6798.7 -11.0	7531.5 -10.9	8249.4 -10.9	8955.3 -10.9	9654.9 -10.7	10355.2 -10.3	11064.3 -9.6	11789.8 -8.6	12537.3 -7.5	13309.9 -6.5	-65
-70	933.7 -14.6	1738.4 -12.9	2554.7 -11.3	3379.4 -9.9	4212.0 -8.5	5053.7 -7.1	5907.8 -5.7	6778.1 -4.3	7668.9 -2.8	8583.4 -1.4	9523.4 -0.2	10488.0 0.8	-70
-75	-3532.7 -17.5	-2710.6 -15.2	-1847.4 -12.8	-947.4 -10.5	-13.4 -8.2	952.6 -5.9	1949.8 -3.7	2977.5 -1.7	4034.9 0.2	5120.3 1.9	6230.9 3.3	7362.0 4.3	-75
-80	-7804.8 -19.2	-6994.2 -16.8	-6112.9 -14.3	-5166.9 -11.8	-4161.8 -9.3	-3103.1 -6.9	-1995.7 -4.5	-845.1 -2.3	343.4 -0.4	1563.5 1.4	2808.7 2.9	4071.4 4.0	-80
-85	-11564.4 -18.8	-10791.1 -16.9	-9924.2 -14.9	-8970.5 -12.9	-7937.7 -10.8	-6833.2 -8.8	-5665.1 -6.8	-4441.7 -4.8	-3171.6 -3.0	-1863.8 -1.3	-527.5 0.3	828.0 1.7	-85
-90	-14562.4 -16.1	-13846.7 -15.1	-13025.6 -14.0	-12105.4 -12.8	-11093.1 -11.4	-9996.3 -10.0	-8823.5 -8.5	-7583.5 -6.9	-6285.7 -5.3	-4940.2 -3.6	-3557.0 -2.0	-2146.8 -0.2	-90
Lat													Lat
E. Long	180	185	190	195	200	205	210	215	220	225	230	235	E. Long

NORTH COMPONENT (X) WMM-95

E. Long / Lat	240	245	250	255	260	265	270	275	280	285	290	295	Lat / E. Long
0	30704.2 -40.4	30594.0 -39.8	30480.6 -38.6	30336.0 -37.6	30130.8 -37.8	29843.5 -39.7	29467.9 -43.3	29016.6 -48.0	28517.4 -52.8	28004.9 -56.8	27511.0 -58.8	27057.5 -58.6	0
-5	30367.5 -37.7	30176.8 -37.1	30009.1 -36.1	29838.5 -35.4	29633.3 -35.6	29364.3 -37.4	29013.5 -41.0	28579.7 -46.1	28078.0 -52.1	27534.4 -58.2	26975.8 -63.3	26422.5 -66.8	-5
-10	29797.5 -34.3	29534.8 -33.9	29307.4 -33.4	29095.7 -33.2	28870.7 -33.7	28601.1 -35.4	28261.3 -38.5	27837.3 -43.3	27330.8 -49.5	26756.2 -56.6	26134.2 -63.7	25484.3 -70.1	-10
-15	29062.7 -31.4	28739.7 -31.3	28448.1 -31.5	28177.4 -32.0	27907.4 -32.7	27610.9 -34.1	27260.2 -36.5	26833.1 -40.4	26318.5 -45.9	25718.4 -52.9	25046.0 -60.8	24318.7 -68.9	-15
-20	28200.4 -29.9	27832.0 -30.2	27478.4 -31.1	27140.1 -32.1	26808.7 -33.1	26466.9 -34.1	26090.3 -35.6	25653.0 -38.2	25134.6 -42.4	24525.2 -48.5	23828.2 -56.1	23057.1 -64.6	-20
-25	27212.0 -30.7	26820.7 -31.2	26422.8 -32.4	26029.1 -33.7	25643.8 -34.6	25260.6 -35.3	24862.2 -36.0	24423.2 -37.3	23917.0 -40.1	23323.7 -44.8	22636.3 -51.4	21861.0 -59.4	-25
-30	26078.8 -33.3	25699.5 -33.7	25296.1 -34.9	24886.6 -36.1	24484.3 -37.0	24092.2 -37.3	23700.1 -37.3	23285.0 -37.8	22817.5 -39.4	22270.3 -42.8	21626.2 -48.1	20882.8 -55.1	-30
-35	24788.0 -36.5	24468.5 -36.7	24117.1 -37.5	23754.0 -38.4	23396.0 -39.0	23050.5 -39.1	22711.3 -39.0	22358.3 -39.1	21961.2 -40.2	21488.3 -42.8	20915.3 -47.2	20231.4 -53.1	-35
-40	23350.4 -38.6	23145.1 -38.4	22911.2 -38.7	22665.5 -39.1	22422.4 -39.5	22187.7 -39.7	21955.4 -39.9	21706.3 -40.4	21410.9 -41.7	21036.6 -44.3	20555.4 -48.2	19951.6 -53.4	-40
-45	21794.6 -37.9	21754.5 -37.3	21696.7 -37.1	21631.3 -37.2	21565.0 -37.6	21497.9 -38.2	21420.4 -39.2	21312.7 -40.6	21146.7 -42.9	20891.3 -46.1	20519.6 -50.2	20014.5 -55.0	-45
-50	20138.8 -33.4	20301.5 -32.5	20460.1 -32.1	20615.9 -32.2	20766.6 -32.9	20904.4 -34.3	21014.5 -36.3	21075.4 -39.0	21060.8 -42.5	20943.2 -46.7	20699.2 -51.4	20314.5 -56.2	-50
-55	18359.3 -25.4	18744.0 -24.5	19135.2 -24.2	19526.6 -24.6	19907.7 -25.9	20263.6 -28.1	20575.0 -31.3	20819.1 -35.2	20971.5 -39.9	21009.0 -45.0	20913.4 -50.2	20674.7 -55.2	-55
-60	16381.0 -15.4	16988.3 -14.8	17606.6 -14.9	18224.4 -15.8	18825.8 -17.7	19391.7 -20.6	19900.7 -24.6	20329.9 -29.4	20657.6 -34.7	20864.9 -40.3	20938.4 -45.7	20871.8 -50.6	-60
-65	14106.5 -5.8	14921.8 -5.5	15746.0 -6.0	16565.0 -7.3	17361.4 -9.7	18115.4 -13.0	18805.9 -17.2	19412.5 -22.1	19916.3 -27.4	20302.6 -32.7	20561.3 -37.8	20688.8 -42.1	-65
-70	11473.1 1.4	12471.2 1.4	13471.5 0.7	14459.9 -0.8	15420.3 -3.1	16335.0 -6.2	17185.8 -10.0	17955.8 -14.2	18629.9 -18.7	19196.5 -23.1	19648.0 -27.2	19981.4 -30.6	-70
-75	8507.1 4.8	9657.5 4.9	10802.3 4.3	11929.3 3.2	13024.9 1.4	14074.7 -0.9	15064.8 -3.6	15982.0 -6.5	16814.9 -9.6	17554.2 -12.6	18193.6 -15.3	18729.5 -17.5	-75
-80	5343.2 4.8	6614.6 5.2	7875.8 5.2	9115.9 4.8	10323.9 4.1	11488.9 3.1	12600.1 1.9	13647.5 0.5	14622.0 -0.9	15515.9 -2.3	16322.9 -3.5	17038.3 -4.4	-80
-85	2192.9 2.9	3557.4 3.9	4911.5 4.7	6245.5 5.4	7549.3 5.9	8813.5 6.3	10028.8 6.6	11186.3 6.8	12277.8 6.9	13295.5 7.0	14232.5 7.1	15082.6 7.3	-85
-90	-720.3 1.5	711.8 3.1	2138.4 4.8	3548.8 6.4	4932.1 8.0	6277.9 9.6	7575.9 11.0	8816.3 12.4	9989.6 13.6	11086.8 14.8	12099.7 15.9	13020.5 16.8	-90
Lat / E. Long	240	245	250	255	260	265	270	275	280	285	290	295	Lat / E. Long

NORTH COMPONENT (X) WMM-95

E. Long	300	305	310	315	320	325	330	335	340	345	350	355	E. Long
Lat													Lat
0	26655.2	26307.7	26016.2	25783.5	25614.5	25515.8	25494.7	25560.5	25724.0	25995.3	26377.5	26859.5	0
	-56.0	-51.7	-46.5	-41.0	-35.9	-31.4	-27.4	-23.6	-20.0	-16.4	-13.3	-11.3	
-5	25884.2	25361.8	24853.9	24363.3	23902.5	23493.2	23163.8	22943.5	22857.2	22919.2	23128.9	23467.8	-5
	-68.2	-67.5	-65.1	-61.3	-56.7	-51.8	-46.6	-41.4	-36.3	-31.5	-27.7	-25.4	
-10	24818.3	24139.4	23447.5	22746.8	22053.6	21397.7	20818.2	20354.5	20037.1	19880.6	19881.3	20017.7	-10
	-74.9	-77.6	-78.1	-76.5	-73.3	-68.8	-63.6	-58.1	-52.6	-47.6	-43.7	-41.2	
-15	23551.9	22754.6	21931.7	21090.3	20247.8	19434.3	18688.7	18049.5	17544.7	17185.9	16967.8	16872.6	-15
	-76.0	-81.5	-84.8	-85.6	-84.4	-81.4	-77.3	-72.6	-67.9	-63.5	-59.8	-57.2	
-20	22229.2	21359.8	20460.6	19543.6	18626.4	17734.9	16901.1	16154.9	15517.0	14994.5	14583.0	14273.0	-20
	-73.0	-80.3	-85.7	-88.9	-89.9	-89.1	-86.9	-84.0	-80.7	-77.3	-74.1	-71.1	
-25	21013.7	20113.7	19179.8	18229.8	17283.1	16362.0	15490.5	14688.9	13969.8	13336.9	12788.7	12324.9	-25
	-67.9	-76.0	-82.8	-87.8	-90.9	-92.3	-92.3	-91.3	-89.6	-87.2	-84.3	-80.5	
-30	20051.1	19151.4	18207.3	17243.2	16282.9	15349.1	14461.5	13635.0	12877.2	12190.6	11577.2	11044.0	-30
	-63.0	-71.1	-78.4	-84.4	-88.9	-91.8	-93.4	-93.9	-93.3	-91.5	-88.4	-83.8	
-35	19441.7	18564.2	17625.7	16656.5	15686.4	14742.5	13846.1	13011.7	12246.9	11555.5	10942.2	10418.0	-35
	-60.1	-67.4	-74.3	-80.4	-85.2	-88.6	-90.8	-91.7	-91.3	-89.3	-85.7	-80.2	
-40	19225.1	18391.5	17478.1	16519.5	15551.4	14606.9	13712.1	12885.4	12137.7	11475.6	10905.8	10438.8	-40
	-59.4	-65.7	-71.6	-76.8	-80.8	-83.6	-85.1	-85.2	-84.0	-81.2	-76.7	-70.6	
-45	19374.0	18611.7	17754.5	16838.4	15902.6	14984.6	14115.4	13318.2	12608.0	11994.3	11484.4	11086.2	-45
	-60.3	-65.4	-70.0	-73.7	-76.1	-77.2	-77.0	-75.5	-72.7	-68.7	-63.3	-56.9	
-50	19787.8	19131.9	18372.4	17544.1	16686.1	15836.8	15029.4	14289.7	13635.7	13078.6	12625.4	12280.3	-50
	-61.0	-65.1	-68.2	-70.1	-70.7	-69.7	-67.5	-64.0	-59.5	-54.2	-48.2	-41.9	
-55	20293.6	19782.9	19166.0	18474.4	17743.7	17009.5	16303.3	15650.9	15070.4	14573.4	14165.5	13847.5	-55
	-59.5	-62.8	-64.7	-65.0	-63.8	-61.1	-57.0	-52.0	-46.2	-40.0	-33.8	-28.1	
-60	20668.1	20339.2	19905.5	19393.4	18832.8	18253.6	17683.1	17143.7	16651.8	16217.5	15844.7	15531.8	-60
	-54.4	-57.0	-58.0	-57.3	-55.0	-51.2	-46.2	-40.3	-34.1	-27.8	-22.0	-17.0	
-65	20688.4	20570.1	20350.0	20048.4	19688.1	19291.9	18881.0	18473.0	18080.6	17711.5	17368.0	17047.2	-65
	-45.4	-47.4	-47.8	-46.7	-44.0	-40.1	-35.1	-29.5	-23.7	-18.0	-13.0	-9.0	
-70	20198.8	20306.8	20316.2	20240.5	20094.9	19894.6	19654.0	19384.9	19095.8	18791.8	18473.7	18138.6	-70
	-33.1	-34.5	-34.6	-33.5	-31.2	-27.9	-23.8	-19.2	-14.6	-10.1	-6.2	-3.1	
-75	19161.6	19492.4	19726.7	19871.4	19934.1	19923.0	19845.3	19707.6	19514.2	19267.6	18967.9	18612.9	-75
	-19.0	-19.8	-19.8	-19.0	-17.3	-15.1	-12.3	-9.2	-6.0	-3.0	-0.3	1.8	
-80	17658.9	18183.3	18611.1	18942.9	19180.5	19325.5	19379.9	19345.5	19223.4	19014.4	18718.1	18334.0	-80
	-5.0	-5.3	-5.1	-4.5	-3.6	-2.3	-0.8	0.9	2.6	4.2	5.6	6.8	
-85	15840.3	16500.9	17060.4	17515.6	17863.9	18103.2	18232.1	18249.8	18155.6	17949.7	17632.3	17204.4	-85
	7.5	7.8	8.1	8.5	9.0	9.6	10.1	10.7	11.2	11.6	11.9	12.1	
-90	13842.2	14558.5	15164.0	15654.2	16025.2	16274.2	16399.4	16399.8	16275.3	16027.0	15656.7	15167.3	-90
	17.6	18.3	18.8	19.2	19.4	19.5	19.5	19.3	18.9	18.4	17.8	17.0	
Lat													Lat
E. Long	300	305	310	315	320	325	330	335	340	345	350	355	E. Long

EAST COMPONENT (Y) WMM-95

E. Long	0	5	10	15	20	25	30	35	40	45	50	55	E. Long
Lat 90	-1088.2 20.3	-924.0 20.4	-752.8 20.3	-575.8 20.1	-394.5 19.7	-210.1 19.2	-24.1 18.6	162.0 17.8	346.9 16.9	529.2 15.8	707.4 14.6	880.3 13.3	Lat 90
85	-1226.6 21.6	-879.0 20.9	-526.1 20.0	-174.3 19.1	170.2 18.0	501.3 16.8	813.3 15.5	1101.2 14.2	1360.2 12.9	1586.5 11.6	1777.1 10.3	1929.7 9.0	85
80	-1382.0 23.4	-893.6 22.1	-401.4 20.6	85.5 19.0	557.9 17.4	1007.3 15.8	1425.1 14.1	1803.4 12.4	2135.0 10.8	2413.3 9.3	2632.6 7.8	2788.6 6.5	80
75	-1510.1 25.3	-925.2 23.5	-339.7 21.6	236.5 19.6	793.9 17.6	1323.3 15.6	1815.5 13.7	2261.5 11.9	2652.5 10.1	2979.6 8.5	3234.7 7.0	3410.2 5.6	75
70	-1580.9 27.2	-938.9 25.0	-302.9 22.7	318.4 20.3	917.1 18.0	1485.2 15.8	2015.1 13.7	2498.3 11.8	2925.7 10.1	3287.5 8.6	3573.6 7.2	3773.3 5.9	70
65	-1582.4 29.4	-914.8 26.7	-263.1 23.9	366.1 21.1	967.5 18.4	1536.5 15.9	2068.0 13.6	2555.6 11.7	2991.5 10.1	3366.0 8.7	3667.8 7.6	3884.7 6.7	65
60	-1519.1 32.0	-847.4 28.9	-205.1 25.4	404.0 21.9	978.5 18.6	1517.8 15.5	2020.5 13.0	2483.2 11.1	2899.8 9.6	3261.4 8.5	3557.1 7.8	3774.4 7.2	60
55	-1407.7 35.3	-744.0 31.6	-126.2 27.3	444.9 22.8	972.8 18.5	1461.9 14.8	1914.9 11.9	2330.8 9.8	2704.8 8.5	3029.0 7.7	3294.0 7.4	3489.1 7.3	55
50	-1275.1 39.4	-622.9 35.0	-36.1 29.6	488.8 23.8	961.1 18.4	1391.2 13.8	1784.9 10.5	2142.4 8.4	2458.3 7.2	2725.1 6.7	2935.6 6.6	3084.0 6.7	50
45	-1155.5 44.1	-512.1 38.7	45.2 31.9	524.6 24.7	943.1 18.1	1317.0 12.8	1654.3 9.2	1953.2 7.2	2204.7 6.2	2400.1 5.9	2535.8 5.8	2614.0 5.8	45
40	-1086.1 48.9	-443.9 42.3	90.9 34.0	533.3 25.4	908.9 17.7	1240.3 12.0	1535.3 8.5	1785.7 6.9	1975.3 6.3	2092.3 6.0	2138.1 5.6	2126.9 5.0	40
35	-1098.9 53.2	-448.7 45.3	74.4 35.5	493.3 25.5	843.8 17.2	1153.8 11.6	1428.0 8.7	1647.4 7.9	1784.3 7.8	1822.3 7.4	1769.3 6.3	1655.5 4.6	35
30	-1213.8 56.4	-547.4 47.1	-24.5 36.0	387.1 25.2	733.1 16.9	1045.5 11.9	1322.5 10.1	1530.7 10.3	1627.3 10.8	1590.3 10.2	1436.0 7.9	1213.8 4.6	30
25	-1436.9 58.3	-749.0 47.7	-215.3 35.7	205.0 24.6	566.5 16.8	902.8 12.9	1202.9 12.6	1416.2 14.0	1483.7 14.9	1377.9 13.6	1125.0 9.9	796.1 4.7	25
20	-1763.9 58.8	-1052.8 47.4	-499.3 35.0	-55.0 24.2	339.5 17.3	715.8 14.9	1051.6 15.9	1278.8 18.2	1323.4 19.1	1154.3 17.0	809.0 11.5	380.6 4.4	20
15	-2185.4 58.3	-1453.2 46.7	-871.6 34.6	-389.2 24.6	52.6 18.8	478.4 17.6	853.1 19.5	1093.3 22.1	1114.2 22.5	884.2 19.0	453.7 11.7	-64.0 2.9	15
10	-2688.1 57.5	-1939.6 46.4	-1323.1 35.2	-789.6 26.3	-289.9 21.5	188.0 20.9	595.2 22.8	837.6 24.7	825.9 23.8	533.2 18.7	23.0 9.8	-573.1 -0.3	10
5	-3249.5 56.9	-2491.8 47.0	-1835.6 37.2	-1242.4 29.4	-680.3 25.1	-156.0 24.2	268.1 25.1	492.6 25.3	431.9 22.4	69.6 15.3	-516.8 5.0	-1181.8 -5.6	5
0	-3829.7 57.0	-3071.7 48.9	-2376.9 40.6	-1724.0 33.7	-1105.9 29.3	-552.3 27.1	-137.4 25.7	40.7 23.2	-91.8 17.7	-534.9 8.8	-1196.9 -2.3	-1922.7 -12.6	0
Lat													Lat
E. Long	0	5	10	15	20	25	30	35	40	45	50	55	E. Long

EAST COMPONENT (Y) WMM-95

E. Long	60	65	70	75	80	85	90	95	100	105	110	115	E. Long
Lat													Lat
90	1046.4	1204.6	1353.6	1492.4	1619.7	1734.8	1836.6	1924.5	1997.7	2055.7	2098.0	2124.4	90
	11.9	10.4	8.9	7.3	5.6	3.8	2.1	0.3	-1.5	-3.2	-5.0	-6.7	
85	2043.1	2117.0	2152.3	2150.7	2115.0	2048.8	1956.8	1843.9	1715.9	1578.6	1438.0	1300.0	85
	7.7	6.5	5.4	4.2	3.2	2.2	1.2	0.3	-0.7	-1.6	-2.5	-3.4	
80	2878.2	2900.0	2854.3	2743.7	2572.6	2347.8	2077.9	1773.5	1446.7	1110.7	779.1	465.7	80
	5.2	4.1	3.2	2.3	1.7	1.1	0.7	0.4	0.2	0.0	-0.2	-0.4	
75	3499.9	3499.4	3406.4	3221.5	2948.8	2595.7	2173.7	1697.7	1186.0	659.6	140.8	-347.3	75
	4.4	3.4	2.5	1.8	1.3	1.0	0.9	1.0	1.3	1.7	2.1	2.4	
70	3877.0	3876.0	3764.1	3538.3	3199.6	2754.5	2214.8	1598.5	929.1	234.7	-452.8	-1100.4	70
	4.8	3.9	3.2	2.6	2.2	2.1	2.2	2.5	3.1	3.7	4.5	5.2	
65	4003.9	4013.1	3902.0	3662.8	3292.6	2794.3	2178.2	1462.9	675.1	-150.6	-974.1	-1752.1	65
	5.9	5.2	4.7	4.4	4.3	4.4	4.7	5.2	5.8	6.5	7.3	8.0	
60	3899.5	3918.5	3817.8	3585.6	3214.1	2701.4	2053.6	1287.3	429.8	-480.7	-1396.9	-2266.3	60
	6.9	6.7	6.7	6.9	7.2	7.7	8.4	9.0	9.7	10.2	10.6	10.9	
55	3602.7	3621.9	3532.5	3320.0	2971.9	2480.2	1845.1	1077.7	202.7	-740.9	-1701.5	-2618.8	55
	7.4	7.7	8.4	9.3	10.5	11.8	13.0	13.9	14.5	14.7	14.4	13.7	
50	3164.3	3168.6	3084.9	2898.0	2591.2	2150.1	1567.1	845.6	4.1	-921.6	-1878.6	-2800.9	50
	7.1	8.0	9.4	11.3	13.6	16.0	18.1	19.5	20.0	19.5	18.1	16.1	
45	2639.0	2611.5	2524.6	2363.6	2108.5	1739.0	1239.3	603.3	-159.7	-1021.0	-1929.9	-2817.7	45
	6.2	7.3	9.4	12.5	16.3	20.2	23.4	25.3	25.5	24.1	21.3	17.5	
40	2077.5	2002.9	1903.0	1764.2	1564.3	1278.0	882.4	361.8	-286.1	-1043.3	-1865.6	-2683.8	40
	4.9	5.9	8.5	12.9	18.3	23.9	28.4	30.8	30.5	27.8	23.1	17.5	
35	1518.5	1385.8	1264.9	1143.2	996.6	797.0	516.5	131.0	-374.7	-996.4	-1700.0	-2419.4	35
	3.4	3.9	6.9	12.5	19.8	27.2	32.9	35.5	34.4	29.9	23.2	15.5	
30	983.3	788.0	641.9	533.1	436.0	321.5	160.3	-79.0	-424.5	-888.2	-1449.5	-2047.4	30
	1.9	1.6	4.9	11.7	20.8	30.0	36.8	39.3	36.9	30.3	21.2	11.6	
25	473.8	217.7	47.6	-49.1	-99.1	-130.1	-171.2	-258.9	-434.3	-727.1	-1131.9	-1594.1	25
	0.3	-0.8	2.6	10.8	21.7	32.5	40.1	42.1	38.1	29.0	17.5	6.2	
20	-25.5	-335.1	-523.6	-604.6	-605.5	-551.9	-471.6	-405.4	-407.6	-525.8	-769.4	-1090.9	20
	-1.6	-3.5	0.5	10.0	22.7	35.0	43.0	44.3	38.2	26.6	12.7	0.0	
15	-542.9	-895.9	-1094.4	-1152.6	-1098.1	-954.8	-749.6	-528.8	-359.5	-306.0	-391.7	-575.2	15
	-4.2	-6.3	-1.5	9.5	24.0	37.5	45.7	45.9	37.8	23.8	7.8	-5.9	
10	-1113.1	-1499.3	-1699.1	-1726.4	-1608.2	-1367.5	-1032.7	-657.1	-320.7	-102.6	-37.7	-89.4	10
	-7.9	-9.5	-3.4	9.4	25.4	39.9	48.1	47.2	37.4	21.5	4.0	-10.3	
5	-1772.1	-2182.8	-2377.3	-2367.2	-2178.0	-1833.2	-1365.0	-835.4	-336.9	38.9	248.0	322.8	5
	-12.7	-13.1	-5.3	9.3	26.8	41.9	50.0	48.4	37.4	20.3	2.0	-12.5	
0	-2553.5	-2981.3	-3165.8	-3114.7	-2851.2	-2399.4	-1797.2	-1116.3	-460.1	69.5	420.8	621.7	0
	-18.4	-16.8	-7.0	9.3	27.8	43.4	51.3	49.3	37.9	20.6	2.4	-11.7	
Lat													Lat
E. Long	60	65	70	75	80	85	90	95	100	105	110	115	E. Long

EAST COMPONENT (Y) WMM-95

E. Long	120	125	130	135	140	145	150	155	160	165	170	175	E. Long
Lat													Lat
90	2134.7 -8.3	2128.6 -9.9	2106.4 -11.4	2068.2 -12.8	2014.2 -14.2	1944.9 -15.4	1860.8 -16.5	1762.5 -17.5	1650.8 -18.3	1526.5 -19.0	1390.6 -19.6	1244.2 -20.0	90
85	1169.9 -4.4	1052.8 -5.4	952.5 -6.5	872.3 -7.7	814.2 -8.9	779.0 -10.2	766.5 -11.5	775.1 -12.9	802.3 -14.3	844.4 -15.7	897.1 -17.1	955.3 -18.5	85
80	183.5 -0.7	-55.9 -1.1	-242.6 -1.8	-369.2 -2.6	-430.9 -3.7	-426.0 -5.0	-355.7 -6.7	-224.3 -8.5	-38.6 -10.6	191.9 -12.9	456.1 -15.4	741.2 -17.8	80
75	-782.5 2.7	-1144.6 2.8	-1416.7 2.6	-1586.0 2.0	-1644.8 1.0	-1590.6 -0.4	-1426.3 -2.4	-1159.8 -4.8	-803.8 -7.7	-374.4 -11.0	109.0 -14.6	625.3 -18.3	75
70	-1675.6 5.8	-2148.6 6.1	-2494.7 6.1	-2695.8 5.7	-2741.3 4.7	-2628.8 3.0	-2363.9 0.7	-1959.5 -2.4	-1434.8 -6.0	-813.7 -10.2	-123.4 -14.9	606.5 -19.8	70
65	-2441.5 8.5	-3002.7 8.8	-3403.1 8.6	-3619.7 7.9	-3640.0 6.6	-3463.2 4.6	-3098.7 1.8	-2565.4 -1.8	-1889.2 -6.0	-1101.6 -11.0	-237.1 -16.4	668.4 -22.2	65
60	-3035.3 10.9	-3655.0 10.5	-4085.3 9.7	-4298.9 8.4	-4283.1 6.5	-4039.7 3.9	-3583.5 0.6	-2939.6 -3.4	-2141.1 -8.1	-1225.6 -13.3	-233.2 -19.0	795.7 -25.0	60
55	-3429.8 12.6	-4076.1 11.2	-4510.8 9.3	-4703.7 7.0	-4642.6 4.2	-4333.6 0.8	-3797.4 -3.0	-3066.0 -7.3	-2178.7 -12.0	-1178.3 -17.1	-109.1 -22.4	986.5 -27.9	55
50	-3617.0 13.5	-4259.6 10.7	-4675.5 7.5	-4831.7 4.0	-4718.4 0.2	-4346.3 -4.0	-3742.8 -8.4	-2946.3 -13.0	-2001.4 -17.5	-955.5 -22.0	144.1 -26.4	1253.4 -30.7	50
45	-3605.3 13.3	-4217.1 8.9	-4593.4 4.5	-4699.7 -0.1	-4528.6 -4.8	-4096.7 -9.7	-3437.5 -14.6	-2594.9 -19.4	-1618.1 -23.7	-558.2 -27.4	534.1 -30.5	1612.9 -33.2	45
40	-3413.3 11.6	-3970.1 5.9	-4288.8 0.7	-4333.6 -4.4	-4100.8 -9.5	-3612.7 -14.8	-2908.5 -20.2	-2036.0 -25.2	-1047.7 -29.3	1.7 -32.4	1057.7 -34.3	2071.1 -35.3	40
35	-3065.2 8.2	-3546.3 1.9	-3791.6 -3.4	-3765.3 -8.2	-3468.0 -13.0	-2928.3 -18.2	-2189.9 -23.7	-1302.9 -29.1	-321.2 -33.5	697.4 -36.4	1693.8 -37.5	2614.6 -37.2	35
30	-2589.6 3.4	-2978.1 -2.9	-3137.6 -7.3	-3033.0 -10.7	-2671.0 -14.3	-2086.0 -18.8	-1325.1 -24.3	-439.1 -30.1	518.2 -35.2	1487.1 -38.6	2404.1 -39.7	3211.8 -38.9	30
25	-2019.7 -2.6	-2304.8 -8.0	-2370.8 -10.5	-2185.2 -11.7	-1761.1 -13.3	-1139.0 -16.5	-368.5 -21.7	501.0 -28.0	1417.1 -34.2	2319.4 -38.8	3141.0 -40.8	3821.9 -40.3	25
20	-1394.9 -8.8	-1572.7 -12.7	-1543.9 -12.8	-1279.7 -11.1	-799.9 -10.2	-150.8 -11.7	617.1 -16.4	1456.4 -23.3	2317.8 -30.7	3141.2 -37.0	3857.9 -40.7	4407.6 -41.5	20
15	-759.6 -14.3	-832.9 -16.6	-714.1 -14.0	-378.7 -9.4	147.1 -5.8	812.8 -5.6	1567.5 -9.5	2367.4 -16.8	3166.5 -25.6	3906.2 -33.7	4518.2 -39.5	4943.6 -42.1	15
10	-160.1 -18.3	-135.7 -19.0	64.3 -14.1	460.2 -7.0	1020.9 -1.1	1693.3 0.6	2427.9 -2.6	3184.7 -10.1	3921.4 -19.9	4582.0 -29.5	5100.0 -37.3	5419.8 -42.0	10
5	360.4 -19.8	475.3 -19.4	746.6 -13.1	1191.9 -4.5	1777.4 2.7	2449.6 5.5	3161.6 2.9	3877.4 -4.5	4558.9 -14.7	5153.1 -25.3	5596.9 -34.4	5838.6 -40.8	5
0	766.4 -18.6	967.6 -17.8	1302.7 -11.2	1788.6 -2.3	2392.0 5.1	3061.5 8.1	3753.6 5.9	4436.0 -1.1	5074.6 -10.9	5620.6 -21.5	6015.0 -31.1	6210.8 -38.4	0
Lat													Lat
E. Long	120	125	130	135	140	145	150	155	160	165	170	175	E. Long

EAST COMPONENT (Y) WMM-95

E. Long / Lat	180	185	190	195	200	205	210	215	220	225	230	235	Lat / E. Long
90	1088.2 -20.3	924.0 -20.4	752.8 -20.3	575.8 -20.1	394.5 -19.7	210.1 -19.2	24.1 -18.6	-162.0 -17.8	-346.9 -16.9	-529.2 -15.8	-707.4 -14.6	-880.3 -13.3	90
85	1013.5 -19.7	1066.0 -20.8	1107.1 -21.8	1131.2 -22.6	1133.6 -23.1	1109.7 -23.4	1056.2 -23.4	970.5 -23.2	851.2 -22.6	697.9 -21.8	511.5 -20.6	294.0 -19.2	85
80	1033.7 -20.3	1319.8 -22.6	1585.9 -24.8	1819.2 -26.7	2008.1 -28.2	2142.7 -29.3	2215.0 -29.9	2219.1 -30.1	2151.6 -29.7	2011.2 -28.9	1799.3 -27.5	1519.4 -25.7	80
75	1152.5 -22.1	1668.3 -25.7	2151.7 -29.1	2583.0 -32.1	2944.9 -34.5	3222.9 -36.3	3405.5 -37.3	3484.6 -37.7	3455.6 -37.2	3317.2 -36.1	3071.5 -34.3	2723.9 -32.0	75
70	1346.4 -24.8	2066.8 -29.7	2740.5 -34.2	3342.5 -38.1	3851.3 -41.2	4249.4 -43.5	4523.1 -44.7	4663.0 -44.9	4664.2 -44.1	4525.5 -42.4	4249.8 -40.0	3843.3 -36.9	70
65	1579.2 -28.0	2461.1 -33.8	3282.9 -39.1	4016.5 -43.7	4638.2 -47.4	5128.8 -49.8	5473.9 -50.9	5663.5 -50.8	5692.5 -49.3	5559.9 -46.8	5268.5 -43.5	4824.5 -39.7	65
60	1822.3 -31.2	2810.5 -37.2	3727.8 -42.9	4546.0 -47.8	5241.2 -51.7	5794.4 -54.2	6191.0 -55.1	6421.3 -54.3	6479.8 -52.1	6364.9 -48.7	6078.7 -44.5	5625.9 -39.9	60
55	2068.7 -33.6	3102.4 -39.3	4057.2 -44.7	4907.6 -49.6	5632.8 -53.4	6215.7 -55.8	6642.9 -56.4	6904.6 -55.2	6994.7 -52.2	6910.2 -47.9	6651.1 -42.8	6219.6 -37.6	55
50	2333.4 -35.2	3352.1 -39.8	4284.8 -44.3	5112.8 -48.6	5821.5 -52.2	6398.6 -54.4	6832.9 -54.8	7114.7 -53.2	7236.1 -49.7	7191.5 -44.6	6978.0 -38.8	6593.6 -33.1	50
45	2640.1 -35.8	3588.7 -38.7	4442.8 -42.0	5194.9 -45.3	5840.9 -48.3	6376.3 -50.3	6793.3 -50.7	7081.5 -48.9	7230.0 -45.0	7229.4 -39.5	7072.7 -33.1	6753.6 -27.1	45
40	3004.3 -36.0	3836.5 -36.9	4563.8 -38.4	5193.8 -40.5	5736.9 -42.8	6198.8 -44.4	6575.5 -44.7	6855.4 -42.8	7023.1 -38.8	7064.3 -33.0	6967.4 -26.5	6722.1 -20.5	40
35	3422.6 -36.1	4104.2 -35.1	4669.6 -34.9	5144.5 -35.5	5556.5 -36.7	5922.0 -37.7	6240.9 -37.6	6498.7 -35.7	6674.7 -31.7	6749.1 -25.9	6706.9 -19.5	6535.0 -13.7	35
30	3873.6 -36.7	4384.2 -34.2	4769.6 -32.3	5074.5 -31.4	5343.0 -31.3	5601.7 -31.3	5852.4 -30.5	6076.7 -28.2	6248.0 -24.1	6342.6 -18.6	6343.4 -12.6	6237.2 -7.3	30
25	4327.6 -37.9	4662.4 -34.7	4867.9 -31.6	5006.4 -29.2	5135.9 -27.5	5289.7 -26.0	5469.1 -23.9	5651.2 -20.8	5804.6 -16.5	5903.4 -11.2	5932.0 -5.9	5879.2 -1.6	25
20	4759.8 -39.8	4929.1 -36.6	4971.4 -32.8	4962.9 -29.0	4971.0 -25.6	5031.4 -22.1	5142.9 -18.3	5277.5 -13.9	5401.0 -8.9	5488.4 -3.9	5528.3 0.4	5514.3 3.3	20
15	5157.8 -41.9	5185.3 -39.3	5093.6 -35.4	4968.2 -30.7	4880.6 -25.4	4865.3 -19.7	4916.4 -13.7	5002.2 -7.5	5087.5 -1.8	5150.7 3.0	5186.9 6.3	5196.0 7.6	15
10	5522.9 -43.5	5442.2 -42.2	5253.3 -38.6	5045.9 -33.2	4891.4 -26.4	4820.5 -18.5	4822.4 -10.0	4862.4 -1.9	4906.4 4.9	4937.4 9.5	4957.4 11.6	4973.2 11.0	10
5	5865.5 -44.0	5715.9 -44.1	5468.9 -41.2	5214.8 -35.7	5021.6 -27.6	4915.3 -17.8	4881.1 -7.2	4882.7 2.8	4887.7 10.7	4883.5 15.2	4877.7 16.1	4883.3 13.7	5
0	6199.0 -42.9	6020.1 -44.3	5752.7 -42.4	5483.9 -37.0	5277.3 -28.4	5154.3 -17.2	5097.7 -4.9	5071.1 6.6	5043.4 15.3	5004.9 19.8	4966.6 19.6	4946.0 15.6	0
Lat													Lat
E. Long	180	185	190	195	200	205	210	215	220	225	230	235	E. Long

EAST COMPONENT (Y) WMM-95

E. Long	240	245	250	255	260	265	270	275	280	285	290	295	E. Long
Lat													Lat
90	-1046.4	-1204.6	-1353.6	-1492.4	-1619.7	-1734.8	-1836.6	-1924.5	-1997.7	-2055.7	-2098.0	-2124.4	90
	-11.9	-10.4	-8.9	-7.3	-5.6	-3.8	-2.1	-0.3	1.5	3.2	5.0	6.7	
85	48.4	-221.1	-509.6	-811.5	-1120.3	-1429.4	-1732.0	-2021.2	-2290.2	-2532.8	-2743.3	-2916.6	85
	-17.4	-15.5	-13.3	-11.0	-8.4	-5.8	-3.1	-0.4	2.3	4.9	7.5	10.0	
80	1177.3	780.8	339.3	-136.1	-633.4	-1139.8	-1642.0	-2127.0	-2582.3	-2996.0	-3357.7	-3658.6	80
	-23.5	-20.9	-18.0	-14.8	-11.5	-7.9	-4.3	-0.7	3.0	6.5	9.9	13.0	
75	2282.6	1758.9	1166.4	520.9	-160.0	-857.4	-1551.8	-2223.5	-2853.9	-3425.4	-3923.0	-4334.0	75
	-29.1	-25.9	-22.3	-18.4	-14.3	-10.1	-5.7	-1.3	3.1	7.5	11.7	15.6	
70	3316.1	2681.2	1954.9	1156.6	308.4	-565.4	-1439.0	-2285.9	-3080.3	-3798.2	-4418.9	-4925.7	70
	-33.4	-29.6	-25.6	-21.3	-16.9	-12.4	-7.6	-2.7	2.4	7.5	12.5	17.2	
65	4237.7	3521.2	2691.6	1769.7	780.3	-247.8	-1282.8	-2290.9	-3238.1	-4092.6	-4826.8	-5418.9	65
	-35.6	-31.5	-27.4	-23.4	-19.3	-14.9	-10.3	-5.2	0.2	6.0	12.0	17.7	
60	5014.1	4254.1	3360.4	2352.5	1255.8	101.9	-1071.8	-2223.9	-3311.7	-4294.0	-5134.8	-5806.1	60
	-35.4	-31.3	-27.7	-24.4	-21.3	-18.0	-14.0	-9.3	-3.6	2.9	9.9	16.8	
55	5619.3	4856.5	3941.1	2888.8	1723.1	476.9	-808.2	-2083.7	-3297.5	-4398.4	-5340.9	-6089.0	55
	-32.9	-29.1	-26.4	-24.6	-23.2	-21.5	-18.8	-14.8	-9.2	-2.1	6.0	14.4	
50	6037.3	5309.0	4412.1	3356.2	2161.0	858.4	-507.3	-1881.3	-3203.3	-4411.9	-5451.7	-6277.8	50
	-28.4	-25.2	-23.9	-23.9	-24.7	-25.3	-24.5	-21.7	-16.5	-8.9	0.3	10.1	
45	6265.5	5601.6	4757.1	3733.9	2546.0	1222.7	-190.8	-1635.5	-3044.0	-4346.7	-5478.5	-6385.3	45
	-22.6	-20.2	-20.4	-22.6	-26.0	-29.2	-30.8	-29.6	-25.1	-17.4	-7.3	4.0	
40	6316.8	5737.7	4971.2	4010.5	2862.1	1551.1	122.2	-1363.7	-2834.8	-4215.1	-5431.9	-6422.3	40
	-16.2	-14.7	-16.4	-20.8	-26.8	-32.7	-36.9	-37.8	-34.6	-27.2	-16.5	-4.0	
35	6217.8	5735.2	5064.7	4189.5	3107.5	1838.2	423.5	-1075.4	-2584.5	-4024.7	-5317.8	-6394.2	35
	-10.0	-9.4	-12.4	-18.7	-27.0	-35.6	-42.5	-45.7	-44.3	-37.8	-27.1	-13.8	
30	6006.3	5625.1	5062.3	4290.2	3296.8	2093.9	719.0	-768.3	-2294.3	-3778.2	-5139.5	-6303.7	30
	-4.3	-4.6	-8.8	-16.5	-26.6	-37.4	-46.8	-52.6	-53.4	-48.6	-38.7	-25.2	
25	5727.7	5447.7	4999.2	4343.1	3455.8	2339.2	1024.4	-432.9	-1960.2	-3476.5	-4900.2	-6154.4	25
	0.4	-0.9	-5.9	-14.5	-25.7	-38.1	-49.6	-57.9	-61.3	-58.8	-50.4	-37.5	
20	5431.4	5247.3	4914.0	4381.2	3612.1	2596.6	1356.1	-59.3	-1579.3	-3122.8	-4606.9	-5953.1	20
	4.0	1.7	-3.9	-12.9	-24.5	-37.7	-50.6	-61.2	-67.4	-67.7	-61.6	-49.8	
15	5167.1	5066.9	4842.0	4431.7	3785.7	2879.6	1722.3	355.2	-1154.5	-2724.7	-4269.4	-5707.8	15
	6.5	3.0	-3.0	-11.8	-23.1	-36.2	-49.9	-62.3	-71.1	-74.5	-71.1	-61.2	
10	4978.9	4943.0	4809.6	4510.6	3983.5	3188.4	2118.3	803.0	-695.2	-2292.1	-3896.4	-5422.4	10
	8.1	3.4	-3.1	-11.4	-21.7	-34.0	-47.6	-61.1	-72.2	-78.5	-78.2	-70.6	
5	4900.0	4901.1	4832.8	4623.8	4202.3	3512.8	2530.5	1270.4	-212.3	-1832.0	-3489.8	-5092.0	5
	8.9	2.9	-3.9	-1	-20.4	-31.3	-44.2	-58.1	-70.8	-79.7	-82.2	-77.1	
0	4949.0	4956.5	4920.9	4773.4	4436.6	3841.7	2945.5	1745.7	287.4	-1344.0	-3042.0	-4702.0	0
	9.2	2.0	-5.1	-11.9	-19.3	-28.6	-40.2	-53.6	-67.1	-77.9	-82.9	-80.3	
Lat													Lat
E. Long	240	245	250	255	260	265	270	275	280	285	290	295	E. Long

EAST COMPONENT (Y) WMM-95

E. Long	300	305	310	315	320	325	330	335	340	345	350	355	E. Long
Lat													Lat
90	-2134.7	-2128.6	-2106.4	-2068.2	-2014.2	-1944.9	-1860.8	-1762.5	-1650.8	-1526.5	-1390.6	-1244.2	90
	8.3	9.9	11.4	12.8	14.2	15.4	16.5	17.5	18.3	19.0	19.6	20.0	
85	-3048.5	-3135.8	-3176.2	-3168.5	-3112.6	-3009.4	-2860.7	-2669.5	-2439.3	-2174.6	-1880.5	-1562.5	85
	12.2	14.3	16.2	17.9	19.3	20.5	21.4	22.0	22.4	22.5	22.4	22.1	
80	-3891.7	-4051.8	-4135.9	-4142.8	-4073.6	-3931.0	-3719.2	-3443.9	-3112.1	-2731.3	-2310.1	-1857.3	80
	15.9	18.6	20.8	22.7	24.2	25.3	26.0	26.4	26.4	26.0	25.4	24.5	
75	-4649.1	-4862.1	-4970.5	-4974.8	-4878.4	-4687.4	-4409.8	-4055.1	-3634.0	-3157.5	-2637.2	-2084.4	75
	19.2	22.3	25.0	27.2	28.8	29.9	30.5	30.5	30.1	29.4	28.3	26.9	
70	-5306.8	-5555.9	-5671.7	-5657.6	-5521.1	-5273.1	-4926.3	-4495.0	-3994.1	-3438.4	-2842.3	-2219.0	70
	21.6	25.5	28.7	31.2	33.0	34.1	34.5	34.3	33.7	32.5	31.1	29.3	
65	-5854.6	-6127.3	-6237.8	-6193.9	-6008.4	-5697.8	-5280.7	-4776.4	-4204.3	-3582.6	-2928.4	-2257.3	65
	23.1	27.8	31.6	34.5	36.5	37.6	37.9	37.6	36.8	35.5	33.8	31.8	
60	-6289.9	-6579.3	-6678.0	-6598.7	-6360.5	-5986.6	-5501.6	-4929.7	-4294.1	-3616.5	-2916.8	-2212.7	60
	23.4	29.1	33.6	37.0	39.1	40.2	40.6	40.3	39.6	38.4	36.8	34.7	
55	-6620.2	-6926.3	-7013.5	-6899.7	-6611.1	-6177.9	-5630.5	-4997.8	-4306.0	-3579.3	-2840.7	-2110.9	55
	22.3	29.1	34.5	38.2	40.5	41.8	42.3	42.3	42.1	41.4	40.2	38.2	
50	-6861.1	-7190.8	-7274.0	-7133.6	-6802.7	-6318.5	-5717.3	-5031.5	-4289.4	-3517.4	-2741.3	-1986.4	50
	19.6	27.7	33.9	38.2	40.7	42.1	43.0	43.7	44.3	44.6	44.2	42.5	
45	-7030.0	-7396.5	-7491.1	-7339.4	-6980.5	-6458.2	-5814.2	-5083.6	-4296.3	-3479.9	-2663.9	-1879.4	45
	15.0	24.5	31.8	36.7	39.7	41.6	43.2	44.9	46.7	48.3	48.8	47.5	
40	-7140.4	-7562.7	-7691.2	-7551.5	-7185.9	-6643.4	-5969.8	-5203.2	-4374.2	-3512.5	-2651.7	-1830.5	40
	8.5	19.5	28.1	34.0	37.8	40.6	43.1	46.1	49.4	52.3	53.8	52.8	
35	-7199.2	-7700.4	-7892.2	-7795.5	-7451.5	-6911.1	-6223.0	-5428.0	-4559.1	-3649.1	-2737.7	-1872.1	35
	0.0	12.7	22.8	30.2	35.4	39.5	43.4	47.9	52.7	56.8	58.9	57.9	
30	-7209.2	-7814.2	-8102.5	-8085.1	-7795.9	-7282.7	-6595.0	-5777.2	-4867.4	-3905.0	-2937.7	-2022.2	30
	-10.3	4.0	16.2	25.7	32.9	38.8	44.4	50.3	56.3	61.3	63.6	62.2	
25	-7172.6	-7904.5	-8321.3	-8419.0	-8217.7	-7756.0	-7081.7	-6244.2	-5291.2	-4273.1	-3248.1	-2282.2	25
	-21.9	-5.9	8.6	20.7	30.4	38.5	46.0	53.3	60.1	65.4	67.5	65.2	
20	-7092.1	-7966.8	-8535.5	-8776.0	-8688.7	-8298.1	-7647.9	-6794.1	-5798.5	-4727.0	-3650.3	-2641.3	20
	-34.1	-16.7	0.2	15.2	27.9	38.5	47.8	56.3	63.6	68.6	70.0	66.7	
15	-6968.5	-7989.4	-8717.7	-9112.3	-9152.2	-8844.7	-8228.0	-7366.3	-6338.3	-5227.8	-4117.2	-3083.0	15
	-45.9	-27.5	-8.4	9.5	25.1	38.3	49.4	58.6	66.0	70.4	71.0	66.9	
10	-6795.7	-7950.7	-8826.1	-9366.0	-9530.0	-9309.4	-8737.3	-7885.7	-6850.4	-5731.2	-4618.9	-3587.6	10
	-56.4	-37.6	-16.7	3.6	21.9	37.3	49.8	59.6	66.8	70.7	70.6	66.0	
5	-6558.6	-7821.0	-8813.4	-9471.2	-9741.6	-9605.1	-9091.4	-8279.0	-7276.2	-6193.3	-5122.6	-4129.1	5
	-64.5	-46.0	-24.3	-2.2	18.0	35.0	48.6	58.8	65.7	69.2	68.9	64.6	
0	-6235.9	-7571.0	-8640.5	-9378.3	-9729.0	-9669.7	-9230.0	-8491.9	-7568.7	-6572.5	-5588.8	-4667.9	0
	-69.7	-52.2	-30.6	-7.8	13.4	31.4	45.6	56.0	62.9	66.4	66.5	63.2	
Lat													Lat
E. Long	300	305	310	315	320	325	330	335	340	345	350	355	E. Long

EAST COMPONENT (Y) WMM-95

E. Long	0	5	10	15	20	25	30	35	40	45	50	55	E. Long
Lat													Lat
0	-3829.7	-3071.7	-2376.9	-1724.0	-1105.9	-552.3	-137.4	40.7	-91.8	-534.9	-1196.9	-1922.7	0
	57.0	48.9	40.6	33.7	29.3	27.1	25.7	23.2	17.7	8.8	-2.3	-12.6	
-5	-4368.9	-3622.0	-2899.1	-2201.0	-1549.6	-998.1	-629.7	-534.2	-765.9	-1304.0	-2042.5	-2821.4	-5
	57.8	51.7	44.8	38.3	32.9	28.5	24.1	18.3	10.1	-0.4	-11.7	-20.8	
-10	-4797.5	-4076.4	-3347.8	-2636.7	-1993.1	-1490.5	-1215.6	-1243.6	-1603.6	-2250.8	-3066.6	-3890.8	-10
	59.0	54.6	48.7	42.0	35.0	27.8	20.0	10.9	0.2	-11.3	-21.9	-29.0	
-15	-5057.6	-4380.9	-3681.2	-3005.4	-2425.8	-2029.3	-1899.3	-2090.5	-2603.9	-3370.7	-4262.2	-5122.3	-15
	59.8	56.5	51.0	43.5	34.5	24.4	13.3	1.4	-10.9	-22.5	-31.6	-36.2	
-20	-5127.7	-4518.4	-3890.5	-3306.9	-2853.5	-2620.7	-2680.9	-3065.4	-3746.7	-4635.4	-5596.3	-6481.5	-20
	59.5	56.5	50.5	41.7	30.7	18.0	4.4	-9.2	-22.0	-32.7	-39.6	-41.4	
-25	-5036.4	-4521.4	-4010.2	-3574.1	-3302.0	-3277.8	-3556.9	-4146.0	-4993.3	-5994.0	-7011.8	-7910.0	-25
	57.4	53.6	46.5	36.2	23.4	9.0	-5.9	-20.0	-32.0	-40.7	-45.0	-43.9	
-30	-4856.5	-4464.5	-4110.2	-3865.2	-3811.1	-4017.5	-4519.5	-5301.3	-6293.4	-7383.2	-8438.9	-9337.7	-30
	53.1	47.8	39.1	27.4	13.4	-1.7	-16.5	-29.7	-39.9	-46.0	-47.3	-43.6	
-35	-4680.3	-4439.5	-4272.1	-4242.9	-4419.4	-4852.1	-5555.2	-6496.0	-7595.3	-8741.1	-9811.5	-10698.8	-35
	46.9	39.6	29.2	16.4	2.0	-12.7	-26.3	-37.5	-45.1	-48.3	-46.9	-41.1	
-40	-4587.3	-4521.8	-4558.3	-4749.9	-5146.5	-5778.4	-6642.4	-7695.0	-8855.7	-10020.3	-11081.2	-11946.1	-40
	39.3	30.0	18.3	4.9	-9.1	-22.6	-34.2	-42.7	-47.4	-47.9	-44.3	-37.2	
-45	-4620.9	-4747.0	-4990.7	-5391.6	-5981.3	-6772.6	-7749.6	-8864.5	-10042.3	-11192.0	-12222.3	-13055.7	-45
	31.3	20.5	8.1	-5.2	-18.2	-29.8	-39.0	-45.0	-47.2	-45.5	-40.5	-32.9	
-50	-4781.8	-5106.0	-5548.6	-6135.9	-6884.0	-7792.2	-8837.1	-9972.5	-11132.6	-12242.0	-13226.0	-14020.8	-50
	23.8	12.4	0.0	-12.4	-23.9	-33.6	-40.5	-44.3	-44.7	-41.8	-36.4	-29.1	
-55	-5040.6	-5558.9	-6183.3	-6928.7	-7799.8	-8786.8	-9864.0	-10989.6	-12109.3	-13162.5	-14090.0	-14839.8	-55
	17.5	6.4	-5.1	-16.1	-25.9	-33.6	-38.8	-41.1	-40.6	-37.5	-32.6	-26.4	
-60	-5358.3	-6058.0	-6841.8	-7715.9	-8677.4	-9712.6	-10796.0	-11892.3	-12957.9	-13945.9	-14809.7	-15507.6	-60
	12.5	2.8	-7.1	-16.4	-24.4	-30.6	-34.5	-36.2	-35.7	-33.2	-29.5	-24.9	
-65	-5703.8	-6566.0	-7484.4	-8459.3	-9483.4	-10542.0	-11612.6	-12666.0	-13668.5	-14584.2	-15377.1	-16014.6	-65
	8.8	0.9	-7.0	-14.4	-20.7	-25.6	-28.9	-30.5	-30.6	-29.3	-27.1	-24.4	
-70	-6061.2	-7063.1	-8090.8	-9140.6	-10203.5	-11265.4	-12307.4	-13306.7	-14237.6	-15073.3	-15787.0	-16353.9	-70
	5.7	-0.1	-5.9	-11.5	-16.3	-20.3	-23.3	-25.1	-26.0	-26.0	-25.3	-24.2	
-75	-6426.9	-7542.2	-8653.4	-9754.1	-10834.6	-11882.4	-12882.3	-13817.2	-14668.4	-15416.5	-16042.7	-16529.3	-75
	2.6	-1.4	-5.4	-9.3	-13.0	-16.2	-18.8	-20.8	-22.3	-23.3	-23.8	-24.0	
-80	-6802.2	-7999.7	-9166.2	-10293.4	-11371.8	-12390.4	-13337.5	-14200.5	-14966.5	-15622.9	-16157.3	-16558.5	-80
	-1.2	-3.8	-6.4	-9.1	-11.7	-14.1	-16.3	-18.3	-19.9	-21.3	-22.4	-23.1	
-85	-7187.1	-8428.5	-9617.5	-10744.8	-11801.1	-12777.1	-13663.7	-14452.1	-15133.9	-15701.4	-16147.5	-16466.2	-85
	-5.8	-7.5	-9.3	-11.1	-12.8	-14.5	-16.0	-17.5	-18.8	-19.9	-20.9	-21.6	
-90	-7575.9	-8816.3	-9989.6	-11086.8	-12099.7	-13020.5	-13842.2	-14558.5	-15164.0	-15654.2	-16025.2	-16274.2	-90
	-11.0	-12.4	-13.6	-14.8	-15.9	-16.8	-17.6	-18.3	-18.8	-19.2	-19.4	-19.5	
Lat													Lat
E. Long	0	5	10	15	20	25	30	35	40	45	50	55	E. Long

EAST COMPONENT (Y) WMM-95

E. Long	60	65	70	75	80	85	90	95	100	105	110	115	E. Long
Lat													Lat
0	-2553.5	-2981.3	-3165.8	-3114.7	-2851.2	-2399.4	-1797.2	-1116.3	-460.1	69.5	420.8	621.7	0
	-18.4	-16.8	-7.0	9.3	27.8	43.4	51.3	49.3	37.9	20.6	2.4	-11.7	
-5	-3483.1	-3920.3	-4090.9	-3997.9	-3660.9	-3104.9	-2373.5	-1546.5	-736.7	-53.7	443.7	776.7	-5
	-24.5	-20.5	-8.6	9.0	28.2	43.8	51.7	49.7	38.7	22.2	5.1	-8.2	
-10	-4572.3	-5010.0	-5161.9	-5027.0	-4621.2	-3969.1	-3118.5	-2155.0	-1196.8	-359.2	291.9	768.2	-10
	-30.1	-23.7	-9.9	8.6	27.8	43.1	50.8	49.2	39.5	24.8	9.5	-2.5	
-15	-5811.7	-6239.3	-6366.4	-6189.9	-5722.0	-4986.4	-4031.9	-2946.3	-1848.8	-857.4	-44.9	587.8	-15
	-34.5	-25.7	-10.7	8.0	26.6	41.0	48.4	47.6	39.7	27.4	14.5	4.2	
-20	-7166.8	-7574.0	-7670.7	-7453.5	-6932.1	-6128.5	-5090.4	-3902.5	-2680.6	-1541.7	-564.6	235.8	-20
	-36.9	-26.3	-10.7	7.4	24.6	37.7	44.6	44.6	38.7	29.2	19.1	10.7	
-25	-8581.2	-8961.3	-9025.0	-8770.5	-8206.6	-7353.5	-6255.2	-4989.9	-3665.2	-2392.8	-1255.2	-281.2	-25
	-37.1	-25.3	-9.9	6.7	22.0	33.4	39.5	40.1	36.2	29.5	22.2	15.9	
-30	-9988.4	-10339.7	-10373.3	-10089.6	-9497.4	-8615.3	-7482.4	-6167.7	-4766.8	-3382.3	-2096.8	-950.6	-30
	-35.1	-22.9	-8.5	6.1	18.9	28.3	33.4	34.4	32.0	27.8	23.1	18.8	
-35	-11326.4	-11653.1	-11665.4	-11365.2	-10761.6	-9871.7	-8729.5	-7393.4	-5945.0	-4474.9	-3061.7	-1754.1	-35
	-31.7	-19.8	-6.9	5.3	15.4	22.6	26.6	27.6	26.4	24.1	21.5	19.1	
-40	-12550.6	-12860.1	-12863.3	-12562.0	-11964.7	-11086.9	-9957.7	-8625.3	-7156.8	-5629.4	-4114.9	-2666.1	-40
	-27.5	-16.6	-5.7	4.0	11.6	16.7	19.4	20.2	19.7	18.7	17.7	16.8	
-45	-13637.7	-13937.5	-13943.2	-13654.8	-13079.0	-12229.5	-11130.8	-9822.1	-8357.6	-6801.0	-5216.0	-3655.5	-45
	-23.8	-14.2	-5.4	1.9	7.3	10.6	12.2	12.5	12.4	12.2	12.3	12.6	
-50	-14579.6	-14873.5	-14888.9	-14622.6	-14078.7	-13268.7	-12212.8	-10943.0	-9502.8	-7944.4	-6322.7	-4688.1	-50
	-21.1	-13.3	-6.4	-1.1	2.4	4.3	5.0	5.1	5.1	5.3	6.1	7.3	
-55	-15371.8	-15658.5	-15684.3	-15442.9	-14935.7	-14171.5	-13167.1	-11948.6	-10551.3	-9017.9	-7395.1	-5729.2	-55
	-20.0	-13.9	-8.9	-5.3	-3.1	-2.0	-1.8	-1.9	-1.8	-1.3	-0.2	1.6	
-60	-16005.6	-16278.4	-16309.3	-16090.0	-15619.7	-14904.5	-13958.5	-12802.9	-11466.8	-9985.3	-8397.8	-6745.0	-60
	-20.3	-16.0	-12.6	-10.2	-8.8	-8.2	-8.1	-8.1	-7.9	-7.1	-5.7	-3.7	
-65	-16468.5	-16716.6	-16743.2	-16539.6	-16103.3	-15438.9	-14557.5	-13476.7	-12220.0	-10816.3	-9298.1	-7700.2	-65
	-21.5	-18.9	-16.8	-15.3	-14.4	-13.9	-13.7	-13.4	-12.9	-11.8	-10.2	-8.0	
-70	-16751.8	-16963.1	-16974.4	-16778.0	-16371.3	-15757.7	-14945.8	-13949.6	-12788.0	-11483.7	-10063.1	-8554.2	-70
	-23.0	-21.7	-20.7	-19.8	-19.2	-18.7	-18.1	-17.5	-16.6	-15.2	-13.4	-11.1	
-75	-16860.6	-17023.8	-17009.2	-16811.1	-16427.8	-15862.0	-15120.1	-14212.9	-13154.6	-11962.7	-10656.9	-9258.8	-75
	-23.9	-23.6	-23.3	-22.9	-22.4	-21.8	-21.0	-20.0	-18.8	-17.2	-15.2	-12.9	
-80	-16816.8	-16924.3	-16875.4	-16667.0	-16298.6	-15772.5	-15093.9	-14270.4	-13312.4	-12232.0	-11043.5	-9762.3	-80
	-23.7	-23.9	-24.0	-23.8	-23.4	-22.7	-21.8	-20.6	-19.2	-17.5	-15.5	-13.3	
-85	-16652.7	-16703.3	-16615.9	-16389.7	-16025.7	-15526.3	-14895.6	-14139.2	-13264.3	-12279.2	-11193.5	-10017.9	-85
	-22.1	-22.4	-22.5	-22.3	-21.8	-21.1	-20.2	-19.1	-17.7	-16.1	-14.3	-12.3	
-90	-16399.4	-16399.8	-16275.3	-16027.0	-15656.7	-15167.3	-14562.4	-13846.7	-13025.6	-12105.4	-11093.1	-9996.3	-90
	-19.5	-19.3	-18.9	-18.4	-17.8	-17.0	-16.1	-15.1	-14.0	-12.8	-11.4	-10.0	
Lat													Lat
E. Long	60	65	70	75	80	85	90	95	100	105	110	115	E. Long

EAST COMPONENT (Y) WMM-95

E. Long	120	125	130	135	140	145	150	155	160	165	170	175	E. Long
Lat													Lat
0	766.4 -18.6	967.6 -17.8	1302.7 -11.2	1788.6 -2.3	2392.0 5.1	3061.5 8.1	3753.6 5.9	4436.0 -1.1	5074.6 -10.9	5620.6 -21.5	6015.0 -31.1	6210.8 -38.4	0
-5	1033.3 -14.8	1321.6 -14.2	1717.5 -8.4	2239.8 -0.6	2859.1 5.8	3528.5 8.3	4208.3 6.1	4869.2 -0.1	5480.7 -9.0	5998.5 -18.6	6369.0 -27.6	6549.8 -35.0	-5
-10	1147.2 -8.8	1529.5 -9.1	1989.2 -5.0	2549.3 0.7	3187.9 5.1	3864.6 6.5	4543.5 4.2	5197.6 -1.3	5798.8 -8.6	6307.5 -16.5	6676.3 -24.1	6868.0 -30.7	-10
-15	1103.8 -1.7	1592.4 -3.0	2125.4 -1.1	2731.2 1.9	3397.4 3.9	4092.3 3.7	4783.7 1.0	5446.1 -3.5	6052.6 -9.1	6568.3 -14.9	6952.4 -20.5	7173.1 -25.7	-15
-20	904.5 5.4	1516.5 3.2	2138.5 3.0	2804.0 3.3	3511.0 2.9	4236.8 1.1	4954.0 -1.9	5637.7 -5.6	6262.3 -9.5	6796.6 -13.3	7206.6 -16.9	7466.5 -20.4	-20
-25	554.6 11.4	1309.4 8.6	2041.3 6.8	2786.0 5.1	3550.5 2.8	4321.0 -0.2	5075.5 -3.4	5790.4 -6.5	6441.3 -9.0	7001.0 -11.0	7441.9 -12.9	7743.9 -15.1	-25
-30	61.6 15.4	977.4 12.7	1841.9 10.1	2688.7 7.2	3529.8 3.9	4359.3 0.4	5160.7 -2.9	5913.3 -5.3	6595.0 -6.9	7182.8 -7.7	7655.3 -8.5	7997.9 -9.7	-30
-35	-564.2 17.0	524.4 14.9	1541.1 12.4	2511.6 9.5	3449.0 6.1	4351.9 2.7	5209.2 -0.2	6004.6 -2.1	6719.8 -3.1	7336.8 -3.4	7839.9 -3.7	8220.1 -4.5	-35
-40	-1309.3 16.1	-47.3 15.0	1131.5 13.5	2241.4 11.3	3291.2 8.7	4281.1 6.1	5204.2 3.9	6048.8 2.5	6801.8 1.9	7450.6 1.8	7985.6 1.6	8402.7 0.8	-40
-45	-2155.7 13.1	-735.0 13.3	601.3 13.0	1854.2 12.2	3025.3 11.0	4113.0 9.7	5112.2 8.5	6015.5 7.8	6814.9 7.4	7503.6 7.3	8077.3 6.9	8536.6 6.0	-45
-50	-3081.7 8.7	-1533.0 10.1	-60.5 11.2	1324.4 11.9	2614.8 12.3	3805.0 12.4	4889.7 12.4	5864.0 12.4	6723.8 12.5	7466.9 12.4	8093.9 11.9	8609.1 11.0	-50
-55	-4062.0 3.7	-2428.4 6.0	-855.9 8.3	635.5 10.4	2030.9 12.1	3320.1 13.6	4495.7 14.7	5553.1 15.6	6490.3 16.2	7308.0 16.5	8010.0 16.3	8603.1 15.6	-55
-60	-5066.4 -1.1	-3397.8 1.7	-1770.2 4.8	-208.6 7.8	1267.1 10.5	2642.5 13.0	3907.5 15.2	5056.5 16.9	6087.3 18.3	7001.3 19.1	7803.2 19.4	8500.9 19.3	-60
-65	-6057.3 -5.3	-4402.7 -2.2	-2766.6 1.2	-1175.3 4.6	349.4 8.0	1790.8 11.2	3136.4 14.0	4378.4 16.5	5513.2 18.5	6541.0 20.1	7465.0 21.1	8291.8 21.8	-65
-70	-6985.9 -8.4	-5386.7 -5.3	-3783.4 -1.9	-2200.4 1.6	-658.8 5.2	823.9 8.6	2234.1 11.8	3562.1 14.7	4801.8 17.3	5950.6 19.4	7009.0 21.2	7979.9 22.5	-70
-75	-7791.1 -10.2	-6276.2 -7.3	-4736.4 -4.1	-3192.2 -0.8	-1662.5 2.6	-163.8 6.0	1290.0 9.2	2687.9 12.3	4021.2 15.0	5284.2 17.5	6473.2 19.7	7586.6 21.5	-75
-80	-8404.8 -10.8	-6988.1 -8.1	-5528.9 -5.3	-4043.9 -2.3	-2548.7 0.7	-1058.0 3.7	414.9 6.6	1858.0 9.5	3261.0 12.1	4614.9 14.6	5912.3 16.8	7147.0 18.7	-80
-85	-8763.7 -10.2	-7443.1 -7.9	-6068.4 -5.6	-4652.4 -3.2	-3207.8 -0.7	-1747.1 1.8	-282.7 4.2	1173.7 6.5	2610.6 8.8	4017.2 10.9	5383.4 12.8	6699.7 14.6	-85
-90	-8823.5 -8.5	-7583.5 -6.9	-6285.7 -5.3	-4940.2 -3.6	-3557.0 -2.0	-2146.8 -0.2	-720.3 1.5	711.8 3.1	2138.4 4.8	3548.8 6.4	4932.1 8.0	6277.9 9.6	-90
Lat													Lat
E. Long	120	125	130	135	140	145	150	155	160	165	170	175	E. Long

EAST COMPONENT (Y) WMM-95

E. Long / Lat	180	185	190	195	200	205	210	215	220	225	230	235	E. Long / Lat
0	6199.0 -42.9	6020.1 -44.3	5752.7 -42.4	5483.9 -37.0	5277.3 -28.4	5154.3 -17.2	5097.7 -4.9	5071.1 6.6	5043.4 15.3	5004.9 19.8	4966.6 19.6	4946.0 15.6	0
-5	6534.4 -40.1	6361.9 -42.5	6106.8 -41.5	5850.2 -36.7	5650.7 -28.1	5526.7 -16.4	5460.2 -3.2	5415.7 9.2	5363.3 18.5	5294.2 22.9	5220.2 22.0	5161.7 16.8	-5
-10	6877.1 -35.7	6739.2 -38.5	6521.5 -38.4	6297.4 -34.6	6120.0 -26.6	6006.1 -15.2	5938.8 -2.0	5884.9 10.6	5815.8 19.9	5722.3 24.2	5615.0 23.0	5515.1 17.2	-10
-15	7225.8 -30.1	7141.1 -33.1	6977.0 -33.7	6798.2 -30.9	6651.8 -24.1	6554.1 -13.8	6491.1 -1.4	6433.9 10.6	6356.0 19.8	6247.5 24.0	6116.8 22.8	5983.8 17.1	-15
-20	7572.4 -23.9	7549.8 -26.7	7447.0 -27.9	7318.8 -26.2	7206.9 -20.9	7127.5 -12.2	7071.6 -1.2	7016.1 9.7	6938.6 18.2	6829.2 22.5	6693.4 21.7	6547.5 16.5	-20
-25	7904.8 -17.7	7945.0 -20.2	7903.7 -21.8	7826.2 -21.1	7748.8 -17.4	7688.6 -10.5	7642.8 -1.3	7595.9 8.2	7531.1 15.9	7439.4 20.1	7323.2 19.9	7193.2 15.8	-25
-30	8210.1 -11.7	8308.8 -14.0	8325.0 -15.9	8295.7 -16.1	8252.8 -13.7	8214.7 -8.6	8185.3 -1.3	8157.5 6.7	8120.9 13.5	8068.3 17.6	7998.2 18.1	7914.0 15.1	-30
-35	8478.8 -6.1	8630.2 -8.3	8699.5 -10.3	8717.2 -11.1	8711.6 -9.9	8702.9 -6.3	8701.0 -0.7	8706.6 5.7	8715.5 11.6	8721.6 15.5	8719.5 16.5	8704.2 14.4	-35
-40	8705.5 -0.8	8907.1 -2.9	9028.7 -5.0	9096.3 -6.1	9135.9 -5.7	9168.8 -3.3	9209.5 0.9	9264.6 5.9	9334.0 10.8	9412.2 14.2	9489.6 15.4	9553.3 13.9	-40
-45	8887.6 4.4	9143.4 2.4	9323.1 0.5	9449.8 -0.8	9547.6 -0.8	9638.1 0.7	9737.9 3.7	9856.7 7.4	9996.2 11.2	10150.3 13.9	10305.7 14.8	10443.1 13.5	-45
-50	9021.3 9.6	9344.0 7.8	9595.4 6.1	9796.5 5.0	9969.5 4.7	10134.7 5.7	10308.4 7.6	10500.3 10.2	10711.9 12.7	10935.7 14.4	11155.6 14.7	11348.7 13.1	-50
-55	9098.0 14.5	9508.5 13.2	9851.9 11.9	10147.2 11.0	10413.7 10.8	10669.3 11.2	10927.5 12.3	11196.0 13.7	11474.4 15.0	11754.0 15.5	12017.5 14.8	12241.0 12.6	-55
-60	9105.0 18.8	9628.9 18.2	10087.8 17.4	10497.8 16.9	10874.8 16.6	11232.4 16.7	11580.5 17.0	11923.5 17.4	12259.0 17.4	12577.3 16.8	12861.9 15.1	13090.7 12.3	-60
-65	9030.3 22.0	9691.2 22.0	10286.5 21.9	10828.3 21.7	11327.7 21.4	11793.8 21.2	12232.3 20.9	12644.3 20.4	13025.8 19.4	13367.5 17.8	13655.2 15.4	13870.7 12.2	-65
-70	8868.4 23.5	9681.0 24.1	10424.7 24.5	11106.7 24.6	11733.0 24.4	12307.9 24.0	12833.4 23.3	13308.0 22.2	13727.3 20.6	14083.2 18.5	14364.8 15.8	14559.1 12.5	-70
-75	8624.5 22.9	9587.7 24.0	10478.0 24.7	11296.8 25.0	12045.4 25.0	12723.7 24.6	13330.7 23.7	13863.4 22.5	14317.5 20.9	14687.0 18.8	14964.6 16.3	15142.5 13.5	-75
-80	8313.8 20.3	9408.5 21.6	10427.5 22.5	11367.2 23.0	12224.7 23.2	12996.5 23.0	13679.2 22.5	14269.0 21.6	14762.0 20.4	15154.0 18.9	15440.7 17.1	15618.2 15.1	-80
-85	7957.3 16.1	9147.8 17.4	10263.8 18.4	11298.3 19.2	12244.9 19.8	13097.7 20.1	13851.5 20.1	14501.7 19.9	15044.0 19.5	15475.0 18.9	15791.8 18.1	15992.4 17.2	-85
-90	7575.9 11.0	8816.3 12.4	9989.6 13.6	11086.8 14.8	12099.7 15.9	13020.5 16.8	13842.2 17.6	14558.5 18.3	15164.0 18.8	15654.2 19.2	16025.2 19.4	16274.2 19.5	-90
Lat / E. Long	180	185	190	195	200	205	210	215	220	225	230	235	Lat / E. Long

EAST COMPONENT (Y) WMM-95

E. Long	240	245	250	255	260	265	270	275	280	285	290	295	E. Long
Lat 0	4949.0 9.2	4956.5 2.0	4920.9 -5.1	4773.4 -11.9	4436.6 -19.3	3841.7 -28.6	2945.5 -40.2	1745.7 -53.6	287.4 -67.1	-1344.0 -77.9	-3042.0 -82.9	-4702.0 -80.3	Lat 0
-5	5130.5 9.1	5116.5 1.0	5082.5 -6.2	4966.3 -12.4	4689.9 -18.4	4174.7 -25.9	3360.5 -35.9	2227.1 -48.5	806.6 -61.9	-819.2 -73.7	-2537.9 -80.5	-4233.8 -80.1	-5
-10	5439.2 8.9	5386.5 0.3	5331.3 -7.0	5221.0 -12.7	4981.3 -17.7	4528.0 -23.7	3788.3 -32.1	2725.1 -43.3	1356.0 -56.0	-244.6 -67.8	-1962.6 -75.6	-3673.2 -76.8	-10
-15	5867.4 8.7	5774.0 0.1	5687.9 -7.2	5567.2 -12.6	5343.6 -17.0	4933.0 -22.0	4254.8 -29.1	3259.3 -38.8	1949.8 -50.3	390.2 -61.4	-1308.7 -69.2	-3017.6 -71.3	-15
-20	6409.5 8.7	6288.6 0.5	6176.0 -6.7	6038.0 -12.1	5814.4 -16.4	5425.5 -21.0	4789.6 -27.2	3850.0 -35.6	2598.7 -45.6	1087.6 -55.4	-580.6 -62.4	-2277.3 -64.5	-20
-25	7062.3 9.0	6937.5 1.4	6811.9 -5.6	6657.3 -11.3	6421.5 -16.0	6032.6 -20.8	5414.5 -26.6	4510.3 -34.0	3305.4 -42.5	1840.7 -50.5	208.0 -56.1	-1470.3 -57.4	-25
-30	7820.2 9.4	7717.2 2.5	7595.1 -4.3	7428.0 -10.5	7170.6 -16.0	6761.5 -21.4	6135.4 -27.3	5241.5 -34.0	4064.6 -40.9	2637.6 -47.1	1040.7 -50.8	-613.8 -50.8	-30
-35	8670.0 9.8	8607.9 3.6	8502.1 -3.2	8326.0 -10.0	8040.3 -16.4	7595.4 -22.6	6939.4 -28.9	6033.1 -35.1	4865.9 -40.8	3466.8 -45.1	1905.7 -46.8	282.4 -45.1	-35
-40	9587.5 10.0	9573.4 4.3	9488.3 -2.5	9304.1 -9.9	8986.6 -17.2	8497.3 -24.2	7799.2 -30.8	6866.9 -36.7	5698.1 -41.3	4321.5 -43.9	2798.9 -43.8	1217.3 -40.3	-40
-45	10538.9 9.9	10566.4 4.4	10497.6 -2.5	10303.3 -10.2	9953.7 -18.1	9420.4 -25.7	8680.1 -32.4	7721.2 -37.9	6550.7 -41.5	5199.2 -42.7	3722.2 -41.0	2194.6 -36.1	-45
-50	11486.7 9.4	11539.1 4.0	11475.4 -2.9	11266.7 -10.7	10887.8 -18.7	10318.8 -26.4	9547.8 -33.0	8574.4 -37.9	7413.6 -40.7	6097.9 -40.7	4677.5 -37.8	3215.9 -31.9	-50
-55	12395.9 8.7	12451.6 3.3	12378.7 -3.5	12151.0 -11.0	11748.3 -18.6	11157.5 -25.7	10374.9 -31.7	9407.7 -36.0	8275.8 -37.9	7012.0 -37.2	5660.6 -33.7	4274.6 -27.4	-55
-60	13238.1 8.1	13277.1 2.8	13182.6 -3.5	12933.3 -10.3	12513.9 -17.1	11917.0 -23.3	11144.1 -28.4	10206.2 -31.7	9124.4 -32.9	7929.0 -31.8	6657.8 -28.2	5353.4 -22.3	-60
-65	13993.6 8.0	14003.2 3.0	13880.5 -2.6	13610.3 -8.3	13182.7 -13.9	12594.4 -18.9	11849.6 -22.8	10960.2 -25.2	9945.3 -25.9	8830.3 -24.7	7645.4 -21.5	6423.3 -16.5	-65
-70	14652.0 8.6	14629.9 4.4	14480.6 -0.2	14195.0 -4.7	13768.1 -9.0	13199.7 -12.6	12495.0 -15.4	11664.6 -17.0	10723.6 -17.4	9691.7 -16.4	8590.8 -14.0	7444.6 -10.3	-70
-75	15212.5 10.3	15167.4 7.0	15001.0 3.7	14709.6 0.4	14291.9 -2.5	13749.8 -5.0	13088.3 -6.9	12315.8 -8.0	11443.3 -8.2	10484.3 -7.7	9453.9 -6.3	8367.6 -4.2	-75
-80	15682.8 13.0	15631.9 10.8	15463.7 8.6	15178.0 6.6	14775.8 4.7	14260.1 3.1	13635.3 1.9	12907.6 1.0	12084.6 0.6	11175.2 0.5	10189.0 0.9	9136.2 1.5	-80
-85	16075.3 16.2	16040.0 15.1	15886.7 14.0	15616.7 12.9	15232.2 11.8	14736.0 10.8	14132.3 9.8	13425.8 9.0	12622.1 8.2	11727.6 7.5	10749.2 6.9	9694.3 6.3	-85
-90 Lat	16399.4 19.5	16399.8 19.3	16275.3 18.9	16027.0 18.4	15656.7 17.8	15167.3 17.0	14562.4 16.1	13846.7 15.1	13025.6 14.0	12105.4 12.8	11093.1 11.4	9996.3 10.0	-90 Lat
E. Long	240	245	250	255	260	265	270	275	280	285	290	295	E. Long

EAST COMPONENT (Y) WMM-95

E. Long / Lat	300	305	310	315	320	325	330	335	340	345	350	355	E. Long / Lat
0	-6235.9 -69.7	-7571.0 -52.2	-8640.5 -30.6	-9378.3 -7.8	-9729.0 13.4	-9669.7 31.4	-9230.0 45.6	-8491.9 56.0	-7568.7 62.9	-6572.5 66.4	-5588.8 66.5	-4667.9 63.2	0
-5	-5808.1 -71.5	-7182.6 -55.7	-8290.8 -35.1	-9071.8 -12.7	-9476.1 8.6	-9486.0 26.8	-9133.4 41.2	-8501.1 51.7	-7699.2 58.7	-6831.9 62.7	-5971.0 63.8	-5148.8 62.1	-5
-10	-5266.4 -70.2	-6656.4 -56.4	-7777.1 -37.4	-8575.2 -16.3	-9013.2 4.2	-9084.2 22.0	-8825.3 36.2	-8316.7 46.7	-7659.3 54.1	-6942.5 58.9	-6220.5 61.2	-5508.5 61.3	-10
-15	-4616.8 -66.2	-6011.8 -54.3	-7134.8 -37.4	-7939.5 -18.0	-8401.8 1.1	-8527.2 17.9	-8359.3 31.7	-7974.0 42.2	-7460.0 50.0	-6889.7 55.5	-6300.5 59.1	-5694.8 60.6	-15
-20	-3876.9 -60.3	-5277.0 -50.0	-6405.7 -35.0	-7220.4 -17.6	-7707.2 -0.1	-7883.0 15.6	-7796.1 28.7	-7518.6 39.1	-7127.0 47.1	-6679.2 53.2	-6201.0 57.4	-5688.4 59.7	-20
-25	-3067.8 -53.4	-4476.6 -44.0	-5619.9 -30.5	-6455.2 -14.8	-6973.6 1.1	-7198.9 15.7	-7182.1 28.1	-6991.4 38.1	-6694.1 45.9	-6339.1 51.8	-5946.7 56.0	-5514.8 58.0	-25
-30	-2204.2 -46.2	-3621.6 -37.1	-4785.8 -24.6	-5651.7 -10.1	-6211.3 4.6	-6489.6 18.2	-6537.6 29.7	-6419.4 39.1	-6196.5 46.2	-5913.8 51.4	-5593.0 54.5	-5239.4 55.2	-30
-35	-1290.6 -39.5	-2709.1 -30.1	-3892.5 -17.8	-4794.2 -4.1	-5403.5 9.7	-5743.2 22.4	-5860.5 33.1	-5815.1 41.5	-5664.5 47.5	-5453.4 51.2	-5208.9 52.5	-4946.1 51.2	-35
-40	-323.7 -33.4	-1729.1 -23.3	-2923.2 -11.1	-3859.6 2.3	-4525.1 15.4	-4937.8 27.3	-5138.8 37.1	-5181.8 44.3	-5120.7 48.8	-5000.9 50.7	-4855.6 49.7	-4709.6 46.0	-40
-45	701.5 -28.0	-675.2 -17.4	-1868.6 -5.1	-2835.7 8.0	-3562.2 20.5	-4060.7 31.5	-4365.1 40.2	-4521.7 46.2	-4579.6 49.1	-4583.7 49.0	-4571.2 45.9	-4573.5 39.9	-45
-50	1783.4 -23.3	447.6 -12.5	-735.9 -0.4	-1730.2 12.1	-2521.4 23.7	-3117.5 33.7	-3544.9 41.3	-3841.5 46.0	-4050.0 47.5	-4212.3 45.8	-4366.3 41.1	-4545.5 33.6	-50
-55	2910.5 -18.9	1621.6 -8.5	451.8 2.8	-569.2 14.1	-1428.8 24.6	-2131.7 33.3	-2697.1 39.7	-3154.4 43.1	-3538.7 43.5	-3886.2 40.8	-4231.6 35.3	-4606.8 27.3	-55
-60	4059.7 -14.5	2817.3 -5.3	1659.6 4.5	609.5 14.2	-322.4 23.0	-1138.0 30.2	-1850.2 35.2	-2480.3 37.7	-3054.8 37.4	-3602.4 34.4	-4151.8 29.0	-4729.3 21.5	-60
-65	5196.8 -10.1	3995.6 -2.8	2844.5 5.0	1760.7 12.6	753.2 19.4	-177.7 24.9	-1039.2 28.6	-1845.1 30.3	-2613.1 29.7	-3363.5 27.0	-4116.6 22.4	-4891.4 16.2	-65
-70	6276.2 -5.8	5106.7 -0.6	3953.9 4.9	2830.9 10.2	1745.6 14.9	700.4 18.6	-307.0 21.0	-1283.2 21.9	-2237.8 21.4	-3182.0 19.2	-4127.3 15.8	-5084.3 11.1	-70
-75	7241.2 -1.5	6088.9 1.5	4923.6 4.6	3755.4 7.6	2591.7 10.3	1437.2 12.3	293.8 13.5	-838.8 13.8	-1962.7 13.2	-3080.8 11.7	-4196.2 9.3	-5311.2 6.2	-75
-80	8027.2 2.4	6871.9 3.5	5679.9 4.6	4459.8 5.6	3219.2 6.4	1964.8 6.9	702.1 7.1	-564.0 6.8	-1829.3 6.0	-3089.9 4.8	-4341.9 3.1	-5581.0 1.1	-80
-85	8570.9 5.8	7387.1 5.4	6151.3 4.9	4871.9 4.3	3557.5 3.7	2216.7 3.0	858.1 2.1	-509.8 1.1	-1878.5 0.0	-3239.3 -1.3	-4583.5 -2.7	-5902.4 -4.2	-85
-90	8823.5 8.5	7583.5 6.9	6285.7 5.3	4940.2 3.6	3557.0 2.0	2146.8 0.2	720.3 -1.5	-711.8 -3.1	-2138.4 -4.8	-3548.8 -6.4	-4932.1 -8.0	-6277.9 -9.6	-90
Lat													Lat
E. Long	300	305	310	315	320	325	330	335	340	345	350	355	E. Long

VERTICAL COMPONENT (Z) WMM-95

Lat \ E. Long	0	5	10	15	20	25	30	35	40	45	50	55	Lat
90	56240.5 -10.1	56240.5 -10.1	56240.5 -10.1	56240.5 -10.1	56240.5 -10.1	56240.5 -10.1	56240.5 -10.1	56240.5 -10.1	56240.5 -10.1	56240.5 -10.1	56240.5 -10.1	56240.5 -10.1	90
85	55178.8 -4.9	55199.8 -5.0	55233.7 -5.2	55280.2 -5.3	55338.9 -5.6	55409.1 -5.9	55489.9 -6.2	55580.2 -6.6	55678.8 -7.0	55784.3 -7.5	55895.2 -8.0	56009.8 -8.5	85
80	53943.8 1.2	53970.5 1.2	54030.8 1.0	54124.4 0.8	54250.4 0.4	54407.4 -0.1	54593.5 -0.8	54806.2 -1.5	55042.6 -2.3	55298.9 -3.3	55571.1 -4.3	55854.4 -5.3	80
75	52627.3 6.6	52647.5 6.9	52723.5 6.9	52854.9 6.7	53040.6 6.3	53279.1 5.8	53567.9 5.1	53903.9 4.2	54283.1 3.1	54700.2 2.0	55148.9 0.7	55621.6 -0.7	75
70	51237.1 10.5	51249.3 11.1	51336.0 11.4	51496.2 11.5	51728.8 11.2	52032.1 10.8	52404.2 10.1	52842.3 9.3	53342.8 8.3	53900.3 7.1	54507.7 5.9	55155.7 4.5	70
65	49715.4 12.7	49730.0 13.8	49831.9 14.5	50018.5 14.8	50287.6 14.7	50637.8 14.3	51067.9 13.7	51576.7 13.0	52161.9 12.1	52819.9 11.1	53544.4 10.1	54325.9 8.9	65
60	47966.1 13.4	48003.6 15.2	48134.4 16.5	48352.9 17.1	48654.9 17.2	49038.7 16.8	49504.0 16.1	50051.6 15.2	50681.9 14.2	51393.4 13.3	52181.7 12.4	53038.7 11.5	60
55	45875.5 12.9	45962.2 15.9	46142.4 18.0	46405.1 19.2	46743.3 19.3	47154.3 18.7	47639.1 17.5	48201.0 16.1	48842.8 14.7	49565.1 13.5	50365.3 12.6	51236.5 11.8	55
50	43321.4 11.5	43483.2 16.2	43734.4 19.6	44056.9 21.3	44438.9 21.5	44877.3 20.4	45375.2 18.5	45938.2 16.3	46571.2 14.2	47275.1 12.5	48046.7 11.2	48879.4 10.2	50
45	40175.4 9.3	40429.6 16.2	40767.4 21.0	41161.1 23.5	41594.3 23.6	42064.2 21.8	42577.2 19.0	43142.1 15.9	43763.5 13.2	44438.8 11.0	45160.5 9.3	45919.4 7.9	45
40	36311.8 6.3	36658.7 15.5	37084.1 21.8	37549.6 24.8	38034.8 24.6	38539.4 22.1	39075.5 18.5	39655.0 14.8	40279.1 11.7	40936.4 9.5	41608.6 7.9	42280.6 6.2	40
35	31627.5 2.2	32046.6 13.6	32541.9 21.1	33064.5 24.3	33591.6 23.5	34129.1 20.2	34697.3 16.0	35310.8 12.3	35963.7 9.9	36628.3 8.5	37269.4 7.6	37861.4 6.1	35
30	26075.2 -3.0	26528.2 9.9	27059.1 17.9	27609.6 20.7	28157.8 19.1	28719.0 15.0	29324.0 10.8	29989.8 8.0	30698.7 7.3	31400.7 8.0	32037.0 8.6	32568.0 7.9	30
25	19699.6 -9.3	20138.5 4.2	20660.4 11.9	21201.0 13.7	21742.5 11.1	22311.8 6.7	22951.5 3.2	23679.2 2.2	24462.1 4.2	25223.3 7.8	25876.3 10.8	26366.0 11.1	25
20	12668.9 -16.8	13041.7 -3.6	13506.1 3.2	13996.3 3.9	14501.3 0.5	15060.3 -3.7	15725.4 -5.8	16512.6 -4.1	17371.3 1.2	18196.0 8.0	18872.6 13.4	19330.4 14.9	20
15	5285.6 -25.0	5538.2 -12.7	5894.8 -7.0	6294.4 -7.1	6735.0 -10.4	7265.4 -13.6	7942.3 -13.7	8774.9 -9.1	9693.8 -0.7	10566.2 8.9	11253.6 16.1	11672.9 18.0	15
10	-2032.1 -33.6	-1956.1 -22.2	-1758.7 -17.0	-1488.5 -16.8	-1137.1 -19.1	-651.5 -20.3	21.1 -17.9	876.8 -10.6	1825.4 0.1	2711.4 11.1	3377.8 18.5	3734.2 19.6	10
5	-8808.2 -41.4	-8961.5 -30.3	-8970.4 -24.5	-8862.9 -22.7	-8620.5 -22.6	-8192.9 -21.1	-7542.0 -16.1	-6692.5 -7.0	-5756.3 4.3	-4906.4 14.8	-4309.6 20.5	-4058.0 19.3	5
0	-14598.7 -47.0	-15014.0 -35.3	-15256.6 -27.5	-15329.4 -22.8	-15205.1 -19.1	-14844.7 -14.5	-14234.5 -7.4	-13427.4 2.2	-12556.9 12.3	-11806.7 19.9	-11344.2 22.0	-11255.7 16.8	0
Lat / E. Long	0	5	10	15	20	25	30	35	40	45	50	55	Lat / E. Long

VERTICAL COMPONENT (Z) WMM-95

E. Long Lat	60	65	70	75	80	85	90	95	100	105	110	115	E. Long Lat
90	56240.5 -10.1	56240.5 -10.1	56240.5 -10.1	56240.5 -10.1	56240.5 -10.1	56240.5 -10.1	56240.5 -10.1	56240.5 -10.1	56240.5 -10.1	56240.5 -10.1	56240.5 -10.1	56240.5 -10.1	90
85	56126.3 -9.0	56243.1 -9.5	56358.4 -10.0	56470.4 -10.6	56577.5 -11.0	56678.2 -11.5	56771.2 -11.9	56855.3 -12.3	56929.6 -12.7	56993.5 -13.0	57046.5 -13.3	57088.6 -13.4	85
80	56143.9 -6.4	56434.1 -7.6	56719.2 -8.8	56993.5 -9.9	57251.5 -11.0	57487.6 -12.1	57697.3 -13.1	57876.2 -14.0	58021.3 -14.7	58130.5 -15.3	58202.6 -15.8	58238.2 -16.1	80
75	56109.4 -2.2	56602.3 -3.8	57089.1 -5.4	57558.1 -7.1	57997.2 -8.8	58394.6 -10.4	58739.1 -12.0	59020.9 -13.4	59232.4 -14.5	59368.1 -15.4	59425.7 -16.0	59405.9 -16.3	75
70	55832.5 3.0	56523.7 1.3	57212.5 -0.5	57880.3 -2.4	58506.9 -4.4	59071.7 -6.3	59554.7 -8.2	59937.7 -9.9	60205.8 -11.3	60348.3 -12.4	60360.1 -13.0	60242.0 -13.1	70
65	55151.3 7.7	56003.5 6.3	56861.2 4.7	57699.4 3.0	58490.0 1.2	59202.9 -0.7	59808.0 -2.5	60276.7 -4.1	60584.9 -5.4	60714.6 -6.3	60656.1 -6.6	60409.8 -6.3	65
60	53951.7 10.6	54902.6 9.6	55868.2 8.6	56819.6 7.4	57722.8 6.1	58540.0 4.9	59231.3 3.7	59757.9 2.8	60085.0 2.2	60185.7 2.1	60044.4 2.5	59659.6 3.6	60
55	52167.6 11.1	53142.2 10.5	54138.4 9.8	55127.3 9.3	56073.2 8.9	56934.0 8.7	57663.0 8.8	58212.3 9.3	58536.9 10.2	58599.9 11.6	58378.1 13.4	57866.0 15.7	55
50	49764.0 9.4	50688.4 8.8	51635.6 8.3	52581.8 8.2	53494.6 8.6	54332.7 9.8	55046.8 11.7	55583.0 14.3	55887.4 17.5	55913.0 21.1	55626.8 24.8	55017.1 28.6	50
45	46708.4 6.7	47521.7 5.5	48351.6 4.7	49184.2 4.6	49995.4 5.8	50749.6 8.3	51399.9 12.4	51890.6 17.7	52162.0 23.8	52157.3 30.0	51832.7 35.9	51167.4 41.1	45
40	42946.6 4.3	43609.7 2.2	44275.4 0.5	44943.3 0.0	45601.5 1.4	46223.9 5.3	46770.4 11.7	47189.0 20.0	47418.3 29.1	47394.5 38.0	47062.1 45.8	46388.7 52.0	40
35	38399.5 3.6	38898.0 0.3	39378.3 -2.8	39856.0 -4.3	40332.3 -2.9	40792.7 2.2	41208.3 10.9	41536.0 22.1	41718.6 34.1	41688.6 45.3	41380.1 54.3	40747.3 60.4	35
30	32989.9 5.0	33329.8 0.3	33627.0 -4.5	33913.0 -7.2	34201.8 -6.0	34490.6 0.3	34764.2 11.2	34993.7 25.1	35132.1 39.6	35112.7 52.1	34860.6 61.1	34316.3 65.9	30
25	26689.4 7.9	26888.1 2.0	27019.5 -4.6	27130.0 -8.6	27244.3 -7.5	27370.8 -0.1	27509.4 13.0	27649.2 29.4	27757.3 45.6	27771.8 58.6	27610.4 66.3	27199.8 68.3	25
20	19568.6 11.4	19643.3 4.0	19629.4 -4.1	19586.9 -9.2	19549.8 -8.0	19536.7 0.8	19562.9 16.1	19636.6 34.6	19740.9 52.0	19819.2 64.5	19782.8 69.9	19544.9 68.2	20
15	11826.5 13.7	11784.3 4.9	11637.5 -4.6	11458.6 -10.4	11291.0 -8.7	11163.4 1.7	11106.2 19.2	11145.1 39.5	11277.1 57.7	11449.3 69.2	11566.0 71.9	11527.7 66.2	15
10	3787.1 13.8	3619.0 3.3	3335.2 -7.5	3020.5 -13.6	2728.6 -11.0	2500.2 1.2	2379.6 20.7	2407.2 42.8	2589.3 61.4	2873.3 71.9	3154.9 72.1	3322.8 63.2	10
5	-4139.1 10.9	-4460.7 -1.7	-4905.8 -13.6	-5378.0 -19.5	-5810.8 -15.8	-6150.3 -1.9	-6338.0 19.5	-6322.6 42.8	-6093.1 61.9	-5705.4 71.8	-5272.8 70.6	-4916.9 59.7	5
0	-11521.5 5.1	-12042.0 -9.7	-12692.0 -22.5	-13364.6 -28.1	-13979.8 -23.3	-14468.3 -7.9	-14758.4 14.7	-14790.1 38.9	-14550.7 58.3	-14100.3 68.3	-13559.8 66.9	-13059.6 56.1	0
Lat E. Long	60	65	70	75	80	85	90	95	100	105	110	115	Lat E. Long

VERTICAL COMPONENT (Z) WMM-95

E. Long	120	125	130	135	140	145	150	155	160	165	170	175	E. Long
Lat													Lat
90	56240.5 -10.1	56240.5 -10.1	56240.5 -10.1	56240.5 -10.1	56240.5 -10.1	56240.5 -10.1	56240.5 -10.1	56240.5 -10.1	56240.5 -10.1	56240.5 -10.1	56240.5 -10.1	56240.5 -10.1	90
85	57120.0 -13.6	57140.9 -13.7	57152.2 -13.7	57154.7 -13.7	57149.2 -13.6	57137.1 -13.5	57119.5 -13.4	57097.5 -13.2	57072.3 -13.1	57045.0 -12.9	57016.6 -12.7	56987.8 -12.5	85
80	58238.7 -16.2	58206.8 -16.1	58146.3 -15.8	58062.0 -15.4	57959.1 -14.9	57843.4 -14.2	57720.8 -13.5	57597.0 -12.8	57477.3 -12.0	57366.7 -11.3	57268.9 -10.7	57187.2 -10.2	80
75	59312.8 -16.2	59153.3 -15.7	58937.2 -14.9	58676.6 -13.8	58385.1 -12.4	58077.1 -10.8	57767.3 -9.1	57469.5 -7.4	57196.5 -5.8	56959.2 -4.4	56766.2 -3.2	56623.7 -2.4	75
70	60001.1 -12.7	59650.7 -11.6	59209.3 -10.0	58699.8 -8.0	58147.7 -5.5	57579.9 -2.7	57023.0 0.2	56502.0 3.0	56039.0 5.5	55652.4 7.7	55356.0 9.3	55159.2 10.2	70
65	59986.3 -5.3	59406.2 -3.6	58699.0 -1.2	57900.7 1.9	57051.4 5.4	56192.7 9.2	55364.7 13.1	54604.3 16.8	53943.2 20.1	53406.9 22.8	53013.9 24.5	52775.7 25.2	65
60	59044.9 5.4	58228.7 7.9	57252.3 11.0	56166.0 14.8	55025.5 18.9	53886.8 23.3	52803.4 27.6	51822.5 31.5	50983.7 34.9	50317.6 37.4	49845.7 38.8	49580.3 38.8	60
55	57078.9 18.4	56052.0 21.6	54838.1 25.3	53501.9 29.2	52113.7 33.2	50743.0 37.2	49453.8 40.9	48301.1 44.1	47329.2 46.5	46571.1 48.0	46048.7 48.3	45773.2 47.2	55
50	54098.2 32.4	52910.5 36.1	51517.0 39.7	49995.6 43.1	48429.7 46.1	46899.8 48.8	45477.8 50.7	44222.9 51.9	43181.1 52.3	42384.9 51.7	41854.3 50.2	41596.8 47.7	50
45	50171.4 45.6	48887.8 49.3	47388.2 52.3	45761.7 54.5	44103.3 55.9	42501.6 56.3	41033.1 55.7	39758.5 54.0	38723.3 51.4	37957.7 48.0	37477.1 44.2	37283.1 40.0	45
40	45376.9 56.5	44069.9 59.5	42545.6 61.2	40902.9 61.7	39245.4 61.1	37667.1 59.1	36246.0 55.7	35041.9 51.0	34098.1 45.1	33441.4 38.6	33081.7 32.1	33010.6 26.0	40
35	39783.0 63.9	38527.7 65.2	37063.6 65.0	35497.6 63.6	33938.9 61.2	32483.3 57.5	31206.5 52.0	30165.1 44.8	29398.9 36.2	28930.9 26.9	28763.9 17.8	28877.3 9.9	35
30	33460.8 67.0	32330.3 65.7	31010.1 63.1	29612.0 60.1	28248.0 56.7	27011.2 52.4	25971.3 46.4	25178.5 38.3	24667.7 28.2	24457.2 17.0	24541.7 5.9	24886.5 -3.8	30
25	26508.8 65.9	25568.6 61.2	24465.9 56.1	23315.7 51.9	22228.9 48.6	21292.0 45.4	20564.7 40.8	20087.6 33.8	19889.4 24.1	19982.2 12.3	20351.5 0.0	20948.5 -11.2	25
20	19062.9 61.5	18362.6 53.0	17531.4 45.5	16685.4 40.7	15931.5 38.7	15346.0 38.1	14975.9 36.7	14850.6 32.6	14990.4 25.0	15400.5 14.3	16057.3 1.8	16898.0 -10.7	20
15	11280.9 55.3	10846.9 43.1	10313.3 33.6	9794.9 28.9	9392.4 29.0	9170.4 31.8	9162.2 34.7	9385.5 34.7	9852.3 30.5	10560.7 21.9	11478.3 10.1	12531.5 -3.0	15
10	3314.3 48.8	3146.4 34.0	2905.2 23.2	2702.7 19.0	2631.9 21.2	2745.7 27.6	3064.8 34.6	3597.0 38.9	4346.9 38.4	5306.9 32.5	6438.0 22.1	7659.8 9.0	10
5	-4709.0 43.5	-4637.0 27.4	-4618.1 16.4	-4545.6 12.9	-4334.8 16.8	-3942.9 25.7	-3359.3 35.7	-2583.4 43.2	-1615.4 45.7	-466.4 42.3	821.5 33.7	2165.5 21.2	5
0	-12678.9 40.1	-12412.4 24.6	-12184.6 14.3	-11896.3 11.6	-11471.2 16.3	-10874.4 26.0	-10101.2 37.1	-9155.7 45.9	-8040.2 50.0	-6767.0 48.4	-5377.4 41.5	-3951.6 30.2	0
Lat													Lat
E. Long	120	125	130	135	140	145	150	155	160	165	170	175	E. Long

VERTICAL COMPONENT (Z) WMM-95

E. Long	180	185	190	195	200	205	210	215	220	225	230	235	E. Long
Lat													Lat
90	56240.5 -10.1	56240.5 -10.1	56240.5 -10.1	56240.5 -10.1	56240.5 -10.1	56240.5 -10.1	56240.5 -10.1	56240.5 -10.1	56240.5 -10.1	56240.5 -10.1	56240.5 -10.1	56240.5 -10.1	90
85	56959.3 -12.3	56931.4 -12.1	56904.5 -12.0	56878.6 -11.8	56853.3 -11.7	56828.5 -11.6	56803.6 -11.5	56778.0 -11.4	56751.1 -11.3	56721.9 -11.2	56690.0 -11.1	56654.4 -11.0	85
80	57123.5 -9.8	57078.7 -9.6	57052.9 -9.5	57044.9 -9.5	57052.8 -9.7	57073.8 -10.0	57104.6 -10.4	57141.2 -10.8	57179.7 -11.3	57215.6 -11.8	57244.9 -12.3	57263.3 -12.7	80
75	56535.1 -2.0	56501.4 -2.0	56520.9 -2.4	56589.5 -3.3	56701.4 -4.4	56848.8 -5.9	57023.0 -7.6	57214.0 -9.4	57411.9 -11.3	57606.2 -13.2	57787.0 -14.9	57944.8 -16.5	75
70	55066.2 10.3	55076.7 9.6	55186.1 8.1	55385.8 5.8	55663.8 2.8	56005.8 -0.7	56395.4 -4.5	56815.1 -8.6	57247.2 -12.6	57673.8 -16.4	58077.9 -20.0	58443.4 -23.1	70
65	52696.8 24.6	52774.6 22.8	53000.9 19.7	53361.9 15.3	53839.1 10.0	54410.8 3.9	55052.9 -2.7	55739.8 -9.4	56445.7 -16.0	57145.3 -22.1	57814.4 -27.6	58430.2 -32.2	65
60	49524.9 37.3	49674.9 34.1	50018.4 29.2	50537.2 22.8	51207.6 15.0	52001.8 6.2	52889.2 -3.2	53837.5 -12.7	54814.2 -21.7	55787.6 -29.9	56727.2 -36.9	57604.8 -42.7	60
55	45746.1 44.5	45960.0 40.1	46400.3 33.9	47045.5 25.8	47869.0 16.1	48840.2 5.2	49924.9 -6.4	51087.3 -18.0	52290.8 -29.0	53499.5 -38.6	54679.2 -46.6	55797.4 -52.7	55
50	41609.8 44.0	41881.3 38.8	42392.8 32.0	43121.0 23.3	44039.2 12.8	45117.5 0.9	46323.6 -11.9	47622.6 -24.7	48977.8 -36.7	50352.7 -46.9	51711.6 -55.0	53020.1 -60.6	50
45	37364.5 35.3	37701.2 29.9	38268.4 23.4	39040.5 15.3	39993.0 5.4	41102.0 -6.1	42342.6 -18.8	43686.6 -31.7	45102.6 -43.6	46556.6 -53.6	48014.4 -60.9	49442.1 -65.3	45
40	33204.4 20.5	33629.4 15.3	34250.8 9.8	35039.4 3.3	35975.3 -4.9	37045.5 -14.9	38238.7 -26.2	39539.4 -37.9	40925.6 -48.9	42369.3 -57.8	43839.9 -63.7	45305.8 -66.4	40
35	29230.1 3.5	29771.1 -1.5	30451.9 -5.9	31239.7 -10.6	32121.3 -16.5	33099.1 -24.1	34180.1 -33.2	35365.7 -43.0	36646.1 -52.2	38000.9 -59.3	39404.2 -63.4	40829.0 -64.1	35
30	25431.5 -11.4	26105.8 -16.7	26847.5 -20.4	27621.4 -23.6	28423.9 -27.5	29275.4 -32.8	30203.5 -39.4	31227.4 -46.8	32349.2 -53.6	33556.0 -58.5	34827.3 -60.4	36142.0 -59.0	30
25	21694.2 -20.3	22500.2 -26.7	23294.6 -30.9	24043.0 -33.9	24754.2 -36.7	25466.9 -40.3	26228.2 -44.7	27071.8 -49.4	28009.3 -53.4	29032.9 -55.7	30128.0 -55.3	31281.2 -51.9	25
20	17828.7 -21.5	18748.2 -29.9	19580.2 -35.9	20296.0 -40.1	20917.7 -43.3	21501.0 -46.2	22107.1 -48.9	22779.3 -51.1	23533.4 -52.1	24365.1 -51.3	25264.8 -48.3	26229.3 -43.0	20
15	13615.7 -15.6	14623.7 -26.5	15480.6 -35.3	16166.8 -42.0	16717.6 -46.9	17201.2 -50.2	17686.8 -51.9	18220.7 -51.8	18818.8 -49.7	19477.4 -45.7	20192.2 -39.8	20970.6 -32.7	15
10	8862.3 -5.1	9938.0 -18.5	10817.8 -30.5	11492.2 -40.3	12007.1 -47.7	12437.8 -52.2	12856.0 -53.4	13305.5 -51.4	13799.1 -46.2	14332.1 -38.8	14903.9 -30.1	15531.3 -21.3	10
5	3456.0 6.5	4589.3 -8.7	5503.8 -23.4	6198.2 -36.2	6725.1 -46.1	7161.9 -52.1	7577.9 -53.2	8012.1 -49.5	8472.0 -41.6	8950.7 -31.0	9448.8 -19.7	9988.0 -9.3	5
0	-2594.6 16.0	-1403.1 0.1	-431.9 -16.0	322.9 -30.8	915.5 -42.7	1421.1 -49.8	1904.1 -51.0	2397.3 -46.0	2903.2 -35.9	3410.9 -22.8	3918.4 -9.3	4446.6 2.2	0
Lat													Lat
E. Long	180	185	190	195	200	205	210	215	220	225	230	235	E. Long

VERTICAL COMPONENT (Z) WMM-95

E. Long	240	245	250	255	260	265	270	275	280	285	290	295	E. Long
Lat 90	56240.5 -10.1	56240.5 -10.1	56240.5 -10.1	56240.5 -10.1	56240.5 -10.1	56240.5 -10.1	56240.5 -10.1	56240.5 -10.1	56240.5 -10.1	56240.5 -10.1	56240.5 -10.1	56240.5 -10.1	Lat 90
85	56614.5 -10.9	56569.9 -10.8	56520.0 -10.6	56464.6 -10.4	56403.6 -10.2	56337.1 -9.9	56265.3 -9.7	56188.7 -9.4	56108.0 -9.0	56023.9 -8.7	55937.5 -8.3	55849.8 -8.0	85
80	57267.3 -13.0	57253.6 -13.3	57219.6 -13.4	57163.1 -13.4	57083.1 -13.3	56978.9 -13.0	56850.9 -12.6	56700.2 -12.1	56528.7 -11.4	56338.9 -10.7	56133.9 -9.8	55917.6 -8.9	80
75	58071.0 -17.8	58158.0 -18.9	58199.6 -19.7	58191.0 -20.3	58128.9 -20.5	58011.9 -20.4	57840.3 -20.1	57616.2 -19.4	57343.6 -18.4	57028.0 -17.2	56676.4 -15.7	56296.8 -14.0	75
70	58755.8 -25.8	59002.0 -27.9	59171.1 -29.6	59254.3 -30.8	59245.4 -31.6	59141.1 -31.8	58941.1 -31.7	58648.8 -31.0	58270.7 -29.8	57816.4 -28.2	57298.5 -26.1	56731.5 -23.5	70
65	58971.9 -36.1	59420.6 -39.2	59759.5 -41.7	59974.6 -43.5	60054.9 -44.8	59993.7 -45.6	59788.9 -45.8	59443.7 -45.5	58967.2 -44.5	58374.2 -42.7	57684.1 -40.1	56920.4 -36.8	65
60	58393.6 -47.3	59068.9 -50.8	59607.3 -53.6	59988.1 -55.7	60193.6 -57.6	60210.8 -59.1	60033.3 -60.2	59662.6 -60.7	59109.2 -60.4	58392.7 -59.0	57540.7 -56.3	56587.0 -52.3	60
55	56823.0 -57.2	57725.7 -60.4	58475.9 -62.9	59044.4 -65.0	59404.5 -67.3	59534.6 -69.7	59420.8 -72.1	59060.1 -74.1	58462.5 -75.2	57651.0 -74.9	56661.3 -72.7	55538.7 -68.5	55
50	54244.6 -64.2	55350.7 -66.3	56302.5 -67.8	57062.0 -69.5	57592.1 -71.9	57859.7 -75.4	57841.1 -79.6	57525.7 -83.8	56920.3 -87.2	56049.3 -88.8	54954.7 -87.9	53692.2 -84.1	50
45	50805.5 -67.2	52067.9 -67.6	53188.0 -67.5	54119.7 -68.3	54814.4 -70.8	55226.7 -75.4	55320.9 -81.7	55077.2 -88.7	54496.1 -95.2	53600.9 -99.6	52436.3 -100.8	51066.0 -98.3	45
40	46734.7 -66.2	48089.6 -64.4	49326.1 -62.5	50390.8 -62.1	51224.4 -64.4	51769.2 -70.0	51977.1 -78.5	51817.9 -88.6	51284.4 -98.7	50395.3 -106.7	49194.5 -111.0	47749.2 -110.7	40
35	42246.8 -61.8	43623.6 -57.8	44914.5 -54.0	46060.9 -52.3	46994.8 -54.1	47646.8 -60.4	47957.2 -70.8	47885.2 -84.1	47414.9 -98.0	46558.1 -110.1	45354.1 -118.5	43868.0 -121.6	35
30	37478.7 -54.8	38810.1 -49.0	40094.3 -43.6	41271.3 -40.6	42265.9 -41.8	42998.9 -48.4	43399.3 -60.1	43415.9 -75.9	43023.2 -93.4	42224.4 -110.0	41050.9 -123.1	39560.8 -130.8	30
25	32481.9 -46.1	33713.5 -39.0	34941.9 -32.4	36109.0 -28.5	37135.7 -29.0	37934.0 -35.3	38421.7 -47.6	38536.1 -65.1	38240.7 -85.6	37528.1 -106.4	36419.3 -124.6	34961.6 -137.8	25
20	27261.7 -36.0	28360.2 -28.3	29502.5 -21.4	30636.7 -17.1	31683.0 -16.9	32546.1 -22.5	33132.1 -34.5	33364.3 -52.5	33192.1 -75.0	32595.2 -99.4	31582.0 -122.6	30187.3 -141.7	20
15	21831.0 -25.0	22788.4 -17.4	23835.6 -10.9	24930.8 -6.7	25997.2 -6.1	26934.7 -10.7	27637.6 -21.5	28012.3 -38.9	27990.0 -62.1	27533.9 -88.9	26638.7 -116.3	25326.5 -141.0	15
10	16246.3 -13.1	17079.7 -6.2	18040.7 -0.8	19100.7 2.6	20191.0 3.2	21210.9 -0.3	22044.3 -9.3	22579.3 -25.0	22725.3 -47.4	22425.4 -75.1	21659.2 -105.4	20438.2 -134.8	10
5	10608.9 -1.1	11354.6 4.8	12249.1 8.6	13279.8 10.7	14391.4 11.0	15488.6 8.6	16449.9 1.6	17146.5 -11.5	17464.7 -31.8	17324.9 -58.8	16690.9 -90.2	15565.5 -122.5	5
0 Lat	5037.7 10.3	5740.9 15.0	6592.4 17.0	7597.0 17.6	8717.5 17.4	9871.7 15.7	10939.8 10.9	11781.6 0.8	12262.4 -16.5	12280.1 -41.2	11781.7 -71.8	10762.7 -104.8	0 Lat
E. Long	240	245	250	255	260	265	270	275	280	285	290	295	E. Long

VERTICAL COMPONENT (Z) WMM-95

E. Long / Lat	300	305	310	315	320	325	330	335	340	345	350	355	E. Long / Lat
90	56240.5	56240.5	56240.5	56240.5	56240.5	56240.5	56240.5	56240.5	56240.5	56240.5	56240.5	56240.5	90
	-10.1	-10.1	-10.1	-10.1	-10.1	-10.1	-10.1	-10.1	-10.1	-10.1	-10.1	-10.1	
85	55762.2	55675.9	55592.2	55512.6	55438.4	55371.0	55311.6	55261.3	55221.3	55192.4	55175.4	55170.7	85
	-7.6	-7.2	-6.9	-6.5	-6.2	-5.9	-5.6	-5.4	-5.2	-5.0	-5.0	-4.9	
80	55693.9	55467.2	55242.1	55022.9	54814.1	54619.9	54444.2	54290.5	54161.8	54060.9	53989.9	53950.4	80
	-7.9	-6.8	-5.8	-4.7	-3.7	-2.7	-1.8	-1.0	-0.3	0.3	0.7	1.0	
75	55898.1	55489.7	55081.1	54681.3	54299.0	53942.2	53618.0	53332.3	53090.3	52896.0	52752.7	52662.6	75
	-12.1	-10.1	-8.0	-5.9	-3.8	-1.8	0.0	1.7	3.1	4.4	5.3	6.1	
70	56131.5	55515.0	54898.3	54296.8	53724.4	53193.1	52712.9	52292.0	51936.6	51651.0	51438.3	51300.1	70
	-20.6	-17.3	-13.9	-10.4	-7.0	-3.7	-0.7	2.1	4.5	6.5	8.2	9.5	
65	56108.5	55274.7	54444.2	53640.0	52881.8	52185.6	51563.8	51025.4	50576.5	50220.4	49958.6	49790.8	65
	-32.7	-28.0	-23.1	-17.9	-12.9	-8.1	-3.8	0.2	3.6	6.6	9.1	11.1	
60	55569.3	54525.8	53492.7	52501.6	51578.4	50742.7	50008.0	49383.0	48872.3	48477.4	48197.2	48028.5	60
	-47.1	-41.0	-34.3	-27.5	-20.8	-14.5	-8.8	-3.8	0.7	4.6	8.0	10.9	
55	54334.2	53100.2	51885.7	50732.4	49672.6	48728.9	47914.7	47237.2	46698.6	46298.4	46032.7	45895.0	55
	-62.5	-55.0	-46.7	-38.1	-29.9	-22.4	-15.7	-9.8	-4.5	0.4	5.0	9.2	
50	52326.7	50925.7	49552.7	48260.8	47089.8	46064.6	45198.1	44494.7	43954.5	43574.6	43349.7	43270.3	50
	-77.6	-69.1	-59.4	-49.5	-40.1	-31.7	-24.4	-18.0	-12.0	-6.0	0.0	6.0	
45	49566.8	48021.1	46507.4	45092.0	43823.0	42728.7	41821.0	41101.7	40568.4	40217.9	40044.7	40037.4	45
	-92.1	-83.1	-72.6	-61.7	-51.7	-43.0	-35.5	-28.8	-22.1	-14.9	-7.0	1.3	
40	46144.2	44473.8	42830.8	41295.1	39924.7	38752.8	37791.8	37042.0	36500.3	36164.6	36031.6	36089.4	40
	-105.9	-97.4	-86.8	-75.8	-65.6	-56.8	-49.4	-42.4	-34.9	-26.1	-15.8	-4.6	
35	42187.0	40412.0	38646.3	36982.0	35488.5	34206.7	33153.5	32331.3	31739.4	31379.5	31251.8	31345.2	35
	-119.3	-112.5	-102.9	-92.4	-82.4	-73.8	-66.2	-58.6	-49.8	-38.9	-25.8	-11.6	
30	37836.5	35978.2	34093.3	32282.6	30627.3	29181.1	27972.0	27011.7	26306.8	25865.3	25691.8	25774.6	30
	-132.5	-128.7	-121.2	-111.9	-102.4	-93.7	-85.4	-76.5	-65.7	-52.3	-36.3	-19.2	
25	33226.6	31305.9	29302.7	27321.6	25455.7	23777.1	22334.8	21159.0	20270.5	19685.2	19410.2	19430.9	25
	-144.7	-145.3	-141.0	-133.5	-124.6	-115.3	-105.7	-94.7	-81.5	-65.3	-46.6	-27.1	
20	28468.4	26502.0	24380.7	22207.3	20086.2	18113.6	16368.5	14909.8	13777.8	12996.9	12572.8	12482.9	20
	-154.6	-160.6	-160.3	-155.1	-146.9	-136.8	-125.2	-111.7	-95.7	-76.8	-56.0	-35.1	
15	23640.6	21641.7	19407.8	17036.5	14642.2	12347.1	10266.1	8491.9	7086.8	6081.5	5474.9	5232.7	15
	-160.2	-172.0	-176.2	-173.9	-166.5	-155.5	-141.9	-125.9	-107.3	-86.4	-64.3	-43.0	
10	18795.2	16778.5	14453.7	11911.7	9274.3	6687.0	4297.6	2230.1	565.4	-664.4	-1470.8	-1901.3	10
	-159.5	-176.9	-185.8	-186.5	-180.2	-168.8	-153.7	-135.8	-115.6	-93.7	-71.4	-50.6	
5	13977.1	11968.9	9599.8	6956.3	4163.6	1381.3	-1221.5	-3501.0	-5367.3	-6792.5	-7800.1	-8447.1	5
	-151.4	-173.5	-186.6	-190.3	-185.8	-174.8	-159.3	-140.7	-120.2	-98.6	-77.1	-57.5	
0	9251.9	7295.7	4954.5	2313.7	-502.5	-3332.9	-6004.6	-8371.7	-10348.0	-11914.7	-13105.6	-13979.6	0
	-136.0	-161.2	-177.7	-184.3	-181.9	-172.3	-157.7	-140.0	-120.6	-100.6	-80.8	-62.5	
Lat													Lat
E. Long	300	305	310	315	320	325	330	335	340	345	350	355	E. Long

VERTICAL COMPONENT (Z) WMM-95

E. Long	0	5	10	15	20	25	30	35	40	45	50	55	E. Long
Lat													Lat
0	-14598.7 -47.0	-15014.0 -35.3	-15256.6 -27.5	-15329.4 -22.8	-15205.1 -19.1	-14844.7 -14.5	-14234.5 -7.4	-13427.4 2.2	-12556.9 12.3	-11806.7 19.9	-11344.2 22.0	-11255.7 16.8	0
-5	-19089.7 -48.5	-19757.1 -35.2	-20222.3 -24.5	-20463.0 -15.9	-20448.1 -8.4	-20157.2 -0.9	-19609.0 7.4	-18888.4 15.9	-18148.1 22.8	-17574.4 25.7	-17324.8 22.4	-17472.5 12.4	-5
-10	-22168.2 -44.2	-23021.1 -28.9	-23647.3 -14.9	-24006.0 -2.6	-24069.8 8.2	-23843.0 17.7	-23380.1 25.7	-22796.7 31.5	-22259.1 33.7	-21946.3 30.7	-21995.8 21.4	-22459.8 6.4	-10
-15	-23934.1 -32.9	-24857.1 -15.8	-25540.8 0.7	-25938.4 15.6	-26034.7 28.3	-25862.3 38.0	-25509.4 44.1	-25115.8 45.8	-24851.9 42.4	-24879.4 33.3	-25306.8 18.5	-26159.1 -0.6	-15
-20	-24647.1 -14.7	-25508.9 3.2	-26136.0 20.7	-26489.9 36.2	-26575.3 48.5	-26452.4 56.3	-26235.8 59.0	-26078.6 55.9	-26144.3 46.9	-26568.3 32.4	-27424.4 13.4	-28707.3 -8.2	-20
-25	-24638.4 9.0	-25335.7 26.3	-25822.4 42.7	-26079.4 56.4	-26135.0 66.0	-26072.1 70.2	-26020.0 68.3	-26132.6 60.2	-26555.5 46.5	-27392.9 28.1	-28682.8 6.8	-30391.6 -15.2	-25
-30	-24230.0 35.7	-24721.1 50.9	-25043.5 64.1	-25202.4 74.0	-25247.2 79.1	-25274.4 78.4	-25415.8 71.6	-25812.8 59.1	-26586.3 41.9	-27807.9 21.6	-29485.3 0.2	-31563.2 -20.3	-30
-35	-23699.0 62.0	-24009.9 73.8	-24206.5 82.7	-24315.9 87.5	-24401.7 87.3	-24562.9 81.6	-24921.1 70.4	-25596.5 54.7	-26681.5 35.8	-28219.7 15.5	-30196.4 -4.3	-32545.6 -21.9	-35
-40	-23290.0 84.6	-23490.9 92.5	-23637.3 96.8	-23770.7 96.6	-23959.1 91.5	-24293.8 81.6	-24877.2 67.5	-25803.2 50.3	-27137.2 31.4	-28900.8 12.6	-31067.7 -4.5	-33571.4 -18.4	-40
-45	-23242.1 101.1	-23410.1 105.5	-23581.3 105.8	-23802.2 101.8	-24136.2 93.4	-24659.6 81.1	-25451.4 65.8	-26579.2 48.7	-28085.1 31.4	-29976.3 15.2	-32223.5 1.4	-34767.7 -9.0	-45
-50	-23794.2 110.6	-23982.8 112.4	-24223.1 110.2	-24559.0 104.1	-25043.5 94.4	-25735.0 81.7	-26689.3 67.2	-27950.9 51.9	-29544.6 37.1	-31469.2 24.0	-33698.1 13.4	-36183.5 5.9	-50
-55	-25150.8 113.7	-25378.3 114.0	-25692.4 110.9	-26129.9 104.6	-26731.0 95.5	-27536.6 84.4	-28583.4 72.1	-29898.3 59.7	-31493.7 48.0	-33364.9 37.9	-35490.0 30.0	-37832.8 24.5	-55
-60	-27427.9 111.9	-27684.9 111.8	-28048.6 109.1	-28546.2 103.9	-29205.8 96.8	-30054.1 88.3	-31112.9 79.2	-32397.2 70.0	-33912.0 61.5	-35651.0 54.1	-37597.4 48.3	-39724.5 44.0	-60
-65	-30618.0 107.4	-30883.2 107.4	-31260.7 105.6	-31768.5 102.3	-32424.4 97.6	-33243.9 92.1	-34239.1 86.0	-35417.0 79.9	-36778.1 74.2	-38316.2 69.0	-40018.3 64.7	-41865.0 61.2	-65
-70	-34597.0 101.8	-34848.6 102.0	-35205.8 101.2	-35679.1 99.4	-36277.7 96.9	-37009.4 93.7	-37879.6 90.2	-38890.1 86.6	-40039.3 82.9	-41321.3 79.4	-42726.1 76.2	-44239.6 73.3	-70
-75	-39163.0 95.8	-39382.2 96.0	-39690.5 95.7	-40092.4 95.0	-40591.4 93.8	-41189.9 92.2	-41888.9 90.4	-42687.5 88.3	-43582.8 86.1	-44569.4 83.8	-45640.1 81.5	-46785.1 79.2	-75
-80	-44073.7 89.3	-44242.2 89.4	-44475.2 89.2	-44773.5 88.8	-45137.3 88.2	-45566.0 87.5	-46058.5 86.5	-46612.7 85.4	-47225.5 84.1	-47892.8 82.7	-48609.7 81.1	-49370.1 79.5	-80
-85	-49056.4 81.9	-49153.2 81.8	-49283.6 81.6	-49447.2 81.3	-49643.1 81.0	-49870.3 80.6	-50127.4 80.1	-50412.7 79.5	-50724.2 78.9	-51059.8 78.1	-51416.7 77.4	-51792.2 76.6	-85
-90	-53798.2 73.3	-53798.2 73.3	-53798.2 73.3	-53798.2 73.3	-53798.2 73.3	-53798.2 73.3	-53798.2 73.3	-53798.2 73.3	-53798.2 73.3	-53798.2 73.3	-53798.2 73.3	-53798.2 73.3	-90
Lat													Lat
E. Long	0	5	10	15	20	25	30	35	40	45	50	55	E. Long

VERTICAL COMPONENT (Z) WMM-95

E. Long	60	65	70	75	80	85	90	95	100	105	110	115	E. Long
Lat													Lat
0	-11521.5	-12042.0	-12692.0	-13364.6	-13979.8	-14468.3	-14758.4	-14790.1	-14550.7	-14100.3	-13559.8	-13059.6	0
	5.1	-9.7	-22.5	-28.1	-23.3	-7.9	14.7	38.9	58.3	68.3	66.9	56.1	
-5	-17987.9	-18766.2	-19677.8	-20607.8	-21463.8	-22161.2	-22615.7	-22760.0	-22579.6	-22136.7	-21556.4	-20975.0	-5
	-2.9	-19.8	-33.1	-38.3	-32.6	-16.5	6.6	31.0	50.7	61.2	61.2	52.2	
-10	-23296.0	-24395.1	-25626.8	-26872.3	-28029.4	-29001.4	-29693.2	-30030.4	-29994.8	-29646.1	-29108.1	-28519.0	-10
	-12.2	-30.5	-43.9	-48.5	-42.2	-26.0	-3.5	20.2	39.7	51.1	53.3	47.7	
-15	-27377.8	-28850.0	-30447.2	-32050.7	-33553.8	-34852.5	-35844.1	-36448.5	-36641.0	-36473.1	-36060.4	-35538.0	-15
	-21.4	-40.1	-52.9	-56.7	-50.2	-34.9	-13.9	8.2	26.8	38.9	43.5	42.0	
-20	-30341.6	-32210.8	-34190.2	-36164.9	-38029.1	-39677.2	-41004.3	-41926.4	-42410.8	-42495.7	-42281.8	-41895.0	-20
	-29.5	-47.3	-58.6	-61.3	-55.0	-41.1	-22.6	-3.1	13.8	25.9	32.6	34.8	
-25	-32429.2	-34677.5	-37016.8	-39339.0	-41543.5	-43528.6	-45192.4	-46450.4	-47261.8	-47648.6	-47690.8	-47498.3	-25
	-35.3	-50.8	-59.9	-61.3	-55.3	-43.4	-27.9	-11.8	2.6	13.8	21.5	26.2	
-30	-33942.9	-36507.9	-39146.1	-41757.2	-44248.7	-46526.7	-48496.8	-50077.1	-51220.5	-51931.7	-52266.8	-52313.2	-30
	-37.6	-50.0	-56.4	-56.4	-50.8	-41.0	-29.0	-16.5	-5.3	4.1	11.4	17.2	
-35	-35168.1	-37954.4	-40801.5	-43618.6	-46321.9	-48827.3	-51049.6	-52912.5	-54365.0	-55395.8	-56036.1	-56347.5	-35
	-35.5	-44.3	-47.9	-46.8	-41.7	-34.1	-25.3	-16.7	-8.9	-2.2	3.6	8.9	
-40	-36320.7	-39218.1	-42172.1	-45101.5	-47931.1	-50586.4	-52992.0	-55078.1	-56792.3	-58110.4	-59041.1	-59620.0	-40
	-28.2	-33.7	-35.1	-33.0	-28.7	-23.2	-17.5	-12.4	-8.0	-4.3	-0.8	2.9	
-45	-37531.5	-40432.9	-43393.2	-46341.0	-49209.2	-51931.4	-54441.3	-56675.7	-58582.9	-60130.4	-61309.1	-62132.4	-45
	-15.6	-18.6	-18.6	-16.3	-13.0	-9.4	-6.4	-4.3	-3.0	-2.1	-1.2	0.1	
-50	-38864.3	-41674.3	-44548.3	-47424.4	-50242.9	-52945.0	-55471.8	-57767.1	-59781.8	-61479.5	-62840.2	-63861.0	-50
	1.5	-0.1	0.4	2.1	4.2	5.8	6.6	6.3	5.2	3.7	2.3	1.4	
-55	-40347.1	-42981.6	-45683.3	-48399.9	-51079.1	-53669.4	-56119.2	-58379.1	-60404.9	-62160.5	-63621.1	-64774.6	-55
	21.3	20.1	20.1	20.7	21.3	21.2	20.2	18.2	15.4	12.2	9.1	6.5	
-60	-41998.2	-44379.7	-46827.1	-49297.5	-51746.9	-54131.2	-56407.0	-58532.6	-60469.7	-62186.3	-63657.7	-64868.4	-60
	41.3	39.6	38.7	38.0	37.1	35.5	33.2	30.1	26.3	22.3	18.2	14.6	
-65	-43831.6	-45889.3	-48006.3	-50149.0	-52282.3	-54371.0	-56380.4	-58277.2	-60030.8	-61614.8	-63007.8	-64194.7	-65
	58.4	56.2	54.3	52.5	50.3	47.7	44.6	41.0	36.9	32.7	28.5	24.6	
-70	-45844.6	-47520.4	-49244.5	-50992.1	-52738.0	-54456.1	-56121.0	-57708.1	-59195.1	-60561.9	-61791.9	-62872.5	-70
	70.6	68.1	65.6	63.0	60.2	57.2	53.9	50.3	46.5	42.7	38.9	35.3	
-75	-47992.9	-49249.9	-50541.4	-51851.3	-53163.2	-54460.1	-55725.3	-56942.9	-58097.8	-59176.8	-60168.0	-61061.9	-75
	76.8	74.4	71.9	69.4	66.7	63.8	60.9	57.9	54.8	51.8	48.8	46.1	
-80	-50167.2	-50993.1	-51839.6	-52697.8	-53558.6	-54412.7	-55250.9	-56064.4	-56844.5	-57583.6	-58274.5	-58911.2	-80
	77.8	76.0	74.1	72.2	70.1	68.1	66.0	64.0	61.9	59.9	58.0	56.2	
-85	-52183.1	-52586.2	-52998.1	-53415.0	-53833.3	-54249.4	-54659.4	-55059.8	-55447.1	-55817.8	-56169.0	-56497.7	-85
	75.7	74.8	73.8	72.9	71.9	70.9	69.9	68.9	68.0	67.1	66.3	65.5	
-90	-53798.2	-53798.2	-53798.2	-53798.2	-53798.2	-53798.2	-53798.2	-53798.2	-53798.2	-53798.2	-53798.2	-53798.2	-90
	73.3	73.3	73.3	73.3	73.3	73.3	73.3	73.3	73.3	73.3	73.3	73.3	
Lat													Lat
E. Long	60	65	70	75	80	85	90	95	100	105	110	115	E. Long

VERTICAL COMPONENT (Z) WMM-95

E. Long	120	125	130	135	140	145	150	155	160	165	170	175	E. Long
Lat													Lat
0	-12678.9	-12412.4	-12184.6	-11896.3	-11471.2	-10874.4	-10101.2	-9155.7	-8040.2	-6767.0	-5377.4	-3951.6	0
	40.1	24.6	14.3	11.6	16.3	26.0	37.1	45.9	50.0	48.4	41.5	30.2	
-5	-20479.6	-20075.3	-19698.2	-19259.8	-18691.6	-17963.5	-17073.3	-16026.4	-14826.0	-13483.5	-12037.1	-10560.4	-5
	38.6	25.4	16.7	14.8	19.3	28.2	38.1	46.1	50.1	49.3	43.7	34.2	
-10	-27973.6	-27491.1	-27023.8	-26497.1	-25850.1	-25054.4	-24107.0	-23012.2	-21773.3	-20400.9	-18928.6	-17421.2	-10
	38.0	28.3	22.1	21.0	24.6	31.2	38.4	43.9	46.3	45.3	40.8	33.1	
-15	-35007.3	-34503.2	-33998.2	-33434.2	-32758.6	-31943.0	-30980.9	-29874.1	-28626.1	-27247.3	-25767.3	-24242.0	-15
	37.0	31.6	28.2	28.0	30.4	34.3	37.9	40.1	40.3	38.5	34.7	29.1	
-20	-41439.2	-40964.4	-40464.7	-39900.5	-39228.9	-38422.1	-37469.6	-36370.8	-35129.3	-33756.6	-32279.7	-30746.3	-20
	34.2	33.0	32.6	33.3	34.8	36.2	36.7	36.0	34.1	31.5	28.4	24.7	
-25	-47171.3	-46770.4	-46309.4	-45768.5	-45116.9	-44330.1	-43396.0	-42312.5	-41084.5	-39725.0	-38259.8	-36730.1	-25
	29.2	31.4	33.4	35.3	36.4	36.4	35.0	32.4	29.4	26.6	24.4	22.5	
-30	-52160.0	-51871.6	-51476.6	-50973.9	-50347.4	-49580.2	-48663.2	-47595.3	-46383.8	-45043.7	-43600.6	-42090.3	-30
	22.1	26.4	30.2	33.1	34.6	34.3	32.5	29.8	27.0	24.9	23.9	23.5	
-35	-56401.2	-56257.2	-55952.7	-55502.1	-54904.9	-54156.1	-53253.7	-52201.7	-51011.0	-49699.3	-48291.6	-46820.1	-35
	14.1	19.1	23.7	27.4	29.6	30.2	29.4	27.9	26.4	25.8	26.2	27.4	
-40	-59897.0	-59921.4	-59731.9	-59353.1	-58798.9	-58077.6	-57197.6	-56170.5	-55012.3	-53743.4	-52388.9	-50977.6	-40
	6.9	11.3	15.8	19.7	22.7	24.6	25.5	26.0	26.7	27.9	30.0	32.5	
-45	-62629.2	-62834.9	-62783.9	-62505.5	-62023.2	-61357.0	-60525.6	-59548.7	-58447.6	-57245.7	-55968.1	-54640.9	-45
	2.3	5.2	8.7	12.3	15.7	18.6	21.3	23.8	26.5	29.6	33.2	36.8	
-50	-64553.7	-64939.9	-65046.3	-64901.3	-64532.4	-63966.1	-63228.5	-62345.0	-61341.3	-60242.5	-59073.6	-57858.5	-50
	1.5	2.5	4.5	7.2	10.3	13.8	17.4	21.3	25.5	29.9	34.5	39.0	
-55	-65621.1	-66171.1	-66442.5	-66458.6	-66245.3	-65830.1	-65240.8	-64504.8	-63648.9	-62698.4	-61677.1	-60606.3	-55
	4.7	4.0	4.5	5.9	8.2	11.3	15.1	19.3	24.0	29.0	34.0	39.0	
-60	-65812.0	-66491.3	-66916.3	-67103.2	-67072.4	-66847.3	-66452.3	-65912.5	-65251.9	-64493.6	-63658.2	-62764.0	-60
	11.7	9.7	8.8	8.9	10.2	12.4	15.4	19.1	23.4	28.1	33.0	37.9	
-65	-65166.9	-65922.3	-66464.7	-66803.3	-66951.2	-66924.9	-66742.2	-66422.1	-65983.4	-65443.9	-64819.9	-64125.5	-65
	21.2	18.6	16.8	16.0	16.2	17.3	19.3	22.0	25.3	29.1	33.2	37.6	
-70	-63795.0	-64555.0	-65152.1	-65589.7	-65874.1	-66014.2	-66020.6	-65904.9	-65679.0	-65354.6	-64942.4	-64452.0	-70
	32.2	29.6	27.6	26.3	25.7	25.9	26.8	28.4	30.6	33.3	36.3	39.8	
-75	-61851.4	-62531.4	-63099.2	-63554.4	-63898.2	-64133.9	-64265.5	-64298.2	-64237.8	-64090.1	-63860.9	-63555.4	-75
	43.6	41.4	39.7	38.4	37.6	37.3	37.5	38.2	39.4	41.0	42.9	45.2	
-80	-59488.4	-60002.0	-60448.8	-60826.8	-61134.8	-61372.5	-61540.2	-61638.9	-61670.3	-61636.1	-61538.6	-61379.8	-80
	54.6	53.2	52.0	51.1	50.4	50.0	50.0	50.2	50.6	51.4	52.4	53.6	
-85	-56801.2	-57077.3	-57324.0	-57539.5	-57722.4	-57871.8	-57986.8	-58067.1	-58112.3	-58122.6	-58098.4	-58040.0	-85
	64.8	64.1	63.6	63.1	62.8	62.6	62.5	62.5	62.6	62.8	63.1	63.5	
-90	-53798.2	-53798.2	-53798.2	-53798.2	-53798.2	-53798.2	-53798.2	-53798.2	-53798.2	-53798.2	-53798.2	-53798.2	-90
	73.3	73.3	73.3	73.3	73.3	73.3	73.3	73.3	73.3	73.3	73.3	73.3	
Lat													Lat
E. Long	120	125	130	135	140	145	150	155	160	165	170	175	E. Long

VERTICAL COMPONENT (Z) WMM-95

E. Long / Lat	180	185	190	195	200	205	210	215	220	225	230	235	E. Long / Lat
0	-2594.6 16.0	-1403.1 0.1	-431.9 -16.0	322.9 -30.8	915.5 -42.7	1421.1 -49.8	1904.1 -51.0	2397.3 -46.0	2903.2 -35.9	3410.9 -22.8	3918.4 -9.3	4446.6 2.2	0
-5	-9149.6 21.4	-7893.1 6.4	-6840.0 -9.7	-5984.9 -25.0	-5276.8 -37.6	-4645.9 -45.3	-4034.6 -46.5	-3415.7 -40.8	-2791.8 -29.4	-2178.6 -14.7	-1583.9 0.1	-993.4 12.2	-5
-10	-15963.9 22.7	-14635.5 9.8	-13480.6 -4.6	-12495.4 -18.9	-11635.7 -31.1	-10840.4 -38.8	-10059.5 -40.0	-9271.2 -34.2	-8481.8 -22.5	-7711.9 -7.5	-6976.2 7.7	-6269.9 19.8	-10
-15	-22744.4 21.4	-21343.2 11.5	-20079.0 -0.1	-18952.0 -12.4	-17927.2 -23.2	-16954.4 -30.3	-15992.4 -31.7	-15023.8 -26.5	-14057.4 -15.6	-13115.7 -1.3	-12218.6 13.1	-11369.7 24.8	-15
-20	-29218.0 19.8	-27753.5 13.2	-26389.7 4.7	-25131.6 -4.9	-23954.6 -14.0	-22821.1 -20.2	-21698.4 -21.8	-20573.0 -17.7	-19452.8 -8.5	-18358.2 4.0	-17309.3 17.0	-16313.7 27.8	-20
-25	-35187.3 20.1	-33681.0 16.3	-32244.6 10.8	-30887.3 3.8	-29595.4 -3.3	-28342.8 -8.8	-27105.0 -10.7	-25870.4 -8.0	-24642.1 -0.8	-23433.7 9.4	-22259.6 20.6	-21125.8 30.3	-25
-30	-40555.9 23.1	-39038.8 21.7	-37569.1 18.5	-36159.2 13.8	-34804.1 8.3	-33487.3 3.7	-32190.5 1.6	-30900.9 3.0	-29614.6 8.1	-28333.9 16.1	-27063.1 25.4	-25802.5 34.0	-30
-35	-45320.6 28.6	-43827.7 28.8	-42367.9 27.4	-40955.1 24.4	-39589.8 20.4	-38261.8 16.7	-36955.7 14.6	-35656.0 15.2	-34349.6 18.8	-33027.0 25.1	-31680.8 32.8	-30304.2 40.6	-35
-40	-49539.7 34.8	-48103.8 36.2	-46692.4 36.2	-45318.8 34.7	-43985.5 32.2	-42684.9 29.6	-41401.9 28.1	-40117.2 28.5	-38810.0 31.4	-37460.6 36.5	-36052.3 43.2	-34572.7 50.4	-40
-45	-53289.8 40.1	-51938.0 42.5	-50603.9 43.7	-49298.2 43.6	-48022.4 42.7	-46769.0 41.6	-45521.9 41.1	-44258.9 42.2	-42954.7 45.1	-41583.8 49.8	-40124.9 55.8	-38563.0 62.4	-45
-50	-56618.9 43.1	-55373.8 46.4	-54136.8 48.7	-52915.2 50.1	-51708.7 50.9	-50508.4 51.5	-49297.7 52.6	-48054.2 54.8	-46751.9 58.2	-45365.4 62.9	-43873.4 68.6	-42262.3 74.7	-50
-55	-59504.5 43.6	-58386.4 47.6	-57262.0 51.0	-56135.5 53.9	-55004.5 56.3	-53859.8 58.7	-52686.3 61.4	-51463.9 64.8	-50170.4 68.9	-48784.7 73.8	-47289.7 79.2	-45676.2 84.7	-55
-60	-61826.1 42.7	-60855.7 47.2	-59859.9 51.4	-58841.0 55.3	-57796.1 59.0	-56717.5 62.8	-55593.3 66.7	-54408.6 71.0	-53147.6 75.6	-51796.1 80.5	-50343.6 85.5	-48785.9 90.3	-60
-65	-63372.2 42.0	-62568.3 46.5	-61719.2 50.9	-60826.5 55.3	-59888.4 59.7	-58900.3 64.1	-57855.0 68.6	-56744.0 73.1	-55558.8 77.7	-54292.4 82.3	-52941.0 86.7	-51505.0 90.6	-65
-70	-63891.3 43.4	-63266.5 47.3	-62581.5 51.3	-61838.5 55.4	-61037.7 59.5	-60177.8 63.7	-59256.7 67.9	-58271.6 72.0	-57220.4 76.1	-56102.0 79.9	-54917.5 83.5	-53670.6 86.6	-70
-75	-63178.6 47.8	-62734.3 50.6	-62226.0 53.6	-61656.2 56.7	-61026.6 59.9	-60338.9 63.2	-59594.2 66.4	-58793.9 69.6	-57939.6 72.7	-57034.1 75.5	-56080.7 78.1	-55084.5 80.4	-75
-80	-61162.3 55.0	-60888.3 56.6	-60560.2 58.4	-60180.3 60.2	-59750.9 62.1	-59274.4 64.1	-58753.4 66.1	-58190.6 68.1	-57589.0 70.0	-56952.1 71.8	-56283.6 73.5	-55587.8 75.0	-80
-85	-57948.4 64.0	-57824.4 64.6	-57669.1 65.2	-57483.9 65.9	-57270.1 66.7	-57029.5 67.5	-56763.7 68.3	-56474.7 69.1	-56164.6 70.0	-55835.5 70.8	-55489.9 71.6	-55130.2 72.4	-85
-90	-53798.2 73.3	-53798.2 73.3	-53798.2 73.3	-53798.2 73.3	-53798.2 73.3	-53798.2 73.3	-53798.2 73.3	-53798.2 73.3	-53798.2 73.3	-53798.2 73.3	-53798.2 73.3	-53798.2 73.3	-90
Lat / E. Long	180	185	190	195	200	205	210	215	220	225	230	235	Lat / E. Long

VERTICAL COMPONENT (Z) WMM-95

E. Long / Lat	240	245	250	255	260	265	270	275	280	285	290	295	E. Long / Lat
0	5037.7	5740.9	6592.4	7597.0	8717.5	9871.7	10939.8	11781.6	12262.4	12280.1	11781.7	10762.7	0
	10.3	15.0	17.0	17.6	17.4	15.7	10.9	0.8	-16.5	-41.2	-71.8	-104.8	
-5	-369.9	336.1	1168.8	2150.2	3264.5	4448.9	5593.4	6554.6	7183.0	7356.5	7005.0	6116.4	-5
	20.0	23.5	24.0	23.2	22.3	21.2	18.4	11.2	-2.5	-23.9	-52.0	-83.8	
-10	-5564.8	-4816.0	-3974.7	-3005.0	-1901.4	-704.3	493.0	1552.1	2317.0	2650.8	2467.7	1745.3	-10
	27.3	29.9	29.3	27.5	26.1	25.3	23.9	19.3	9.0	-8.6	-33.0	-61.8	
-15	-10550.3	-9722.4	-8837.1	-7849.7	-6738.0	-5521.8	-4275.8	-3126.0	-2226.4	-1721.9	-1711.6	-2230.1	-15
	31.9	34.2	33.2	31.0	29.3	28.6	27.9	25.1	17.5	3.5	-16.8	-41.7	
-20	-15360.1	-14417.6	-13441.8	-12386.7	-11222.0	-9953.6	-8639.4	-7390.1	-6350.6	-5665.9	-5443.9	-5731.9	-20
	34.6	37.1	36.5	34.5	32.7	31.9	31.3	29.1	23.1	11.9	-4.8	-25.5	
-25	-20024.6	-18932.5	-17813.9	-16629.2	-15350.6	-13979.7	-12563.5	-11197.6	-10013.1	-9147.7	-8711.4	-8761.5	-25
	36.9	40.0	40.3	39.0	37.4	36.2	35.0	32.3	26.8	17.1	3.1	-14.0	
-30	-24545.1	-23274.6	-21967.3	-20597.5	-19148.8	-17627.8	-16077.6	-14581.8	-13255.1	-12221.8	-11586.4	-11410.3	-30
	40.7	44.6	45.9	45.5	44.2	42.4	39.9	36.0	29.6	20.3	7.9	-6.4	
-35	-28889.6	-27428.1	-25909.4	-24325.5	-22676.8	-20981.3	-19283.7	-17658.7	-16204.9	-15028.5	-14221.9	-13842.9	-35
	47.2	51.8	54.2	54.6	53.3	50.7	46.6	40.9	33.1	23.2	11.5	-1.1	
-40	-33014.1	-31374.4	-29656.6	-27869.5	-26031.1	-24172.3	-22342.0	-20608.4	-19054.4	-17767.1	-16821.7	-16266.7	-40
	56.9	61.9	64.9	65.7	64.2	60.7	55.1	47.6	38.3	27.4	15.8	4.4	
-45	-36892.1	-35115.8	-33247.5	-31309.4	-29332.6	-27358.4	-25438.7	-23635.7	-22018.4	-20654.9	-19602.5	-18897.0	-45
	68.7	73.7	76.7	77.5	75.7	71.3	64.6	55.8	45.4	34.0	22.5	12.0	
-50	-40529.0	-38681.6	-36739.7	-34732.8	-32699.1	-30684.3	-28739.8	-26921.1	-25284.2	-23880.9	-22752.1	-21921.8	-50
	80.4	84.9	87.7	88.1	85.9	81.1	73.8	64.6	54.0	42.8	32.0	22.6	
-55	-43944.2	-42104.9	-40179.9	-38200.2	-36204.2	-34235.8	-32341.6	-30568.5	-28961.0	-27557.2	-26385.3	-25460.4	-55
	89.6	93.4	95.5	95.5	93.1	88.4	81.5	72.9	63.2	53.2	43.8	35.8	
-60	-47126.5	-45377.5	-43559.6	-41700.4	-39833.7	-37996.4	-36226.9	-34562.3	-33036.1	-31676.0	-30501.2	-29521.4	-60
	94.3	97.3	98.8	98.5	96.3	92.2	86.4	79.4	71.6	63.7	56.3	50.2	
-65	-49990.4	-48408.8	-46777.6	-45118.9	-43458.6	-41824.7	-40245.6	-38748.2	-37356.4	-36089.5	-34961.0	-33978.1	-65
	93.8	96.1	97.2	97.0	95.4	92.4	88.3	83.4	78.0	72.6	67.6	63.6	
-70	-52368.2	-51020.2	-49640.0	-48243.5	-46848.4	-45473.5	-44137.9	-42859.2	-41653.5	-40533.6	-39509.3	-38586.6	-70
	89.1	90.9	91.8	92.0	91.2	89.7	87.4	84.7	81.8	78.8	76.1	74.0	
-75	-54051.8	-52990.4	-51909.4	-50819.1	-49730.6	-48655.3	-47604.5	-46589.0	-45618.6	-44701.8	-43845.3	-43054.4	-75
	82.4	83.8	84.9	85.4	85.5	85.2	84.6	83.7	82.7	81.7	80.8	80.1	
-80	-54869.6	-54134.2	-53387.3	-52634.7	-51882.8	-51137.8	-50405.8	-49692.9	-49004.6	-48346.2	-47722.2	-47136.8	-80
	76.4	77.6	78.6	79.4	80.0	80.5	80.8	81.0	81.2	81.3	81.4	81.6	
-85	-54759.0	-54379.1	-53993.1	-53603.9	-53214.3	-52827.3	-52445.7	-52072.2	-51709.6	-51360.4	-51027.2	-50712.2	-85
	73.2	73.9	74.6	75.2	75.8	76.4	76.9	77.4	77.8	78.3	78.7	79.1	
-90	-53798.2	-53798.2	-53798.2	-53798.2	-53798.2	-53798.2	-53798.2	-53798.2	-53798.2	-53798.2	-53798.2	-53798.2	-90
	73.3	73.3	73.3	73.3	73.3	73.3	73.3	73.3	73.3	73.3	73.3	73.3	
Lat													Lat
E. Long	240	245	250	255	260	265	270	275	280	285	290	295	E. Long

VERTICAL COMPONENT (Z) WMM-95

E. Long	300	305	310	315	320	325	330	335	340	345	350	355	E. Long
Lat													Lat
0	9251.9	7295.7	4954.5	2313.7	-502.5	-3332.9	-6004.6	-8371.7	-10348.0	-11914.7	-13105.6	-13979.6	0
	-136.0	-161.2	-177.7	-184.3	-181.9	-172.3	-157.7	-140.0	-120.6	-100.6	-80.8	-62.5	
-5	4721.8	2875.8	646.9	-1876.3	-4573.9	-7294.9	-9879.9	-12198.5	-14179.2	-15815.9	-17147.3	-18225.4	-5
	-115.0	-141.5	-160.0	-169.1	-169.1	-161.7	-149.3	-133.7	-116.6	-98.9	-81.1	-64.0	
-10	514.9	-1160.4	-3200.8	-5511.7	-7978.1	-10465.5	-12839.3	-14995.2	-16883.1	-18508.7	-19910.2	-21125.6	-10
	-91.2	-117.1	-136.2	-146.8	-149.0	-144.2	-134.5	-121.9	-107.6	-92.3	-76.4	-60.2	
-15	-3251.2	-4707.5	-6509.2	-8554.8	-10731.9	-12922.7	-15018.4	-16942.3	-18664.6	-20199.3	-21579.6	-22827.7	-15
	-67.9	-91.6	-109.8	-120.8	-124.4	-121.8	-114.8	-104.8	-93.1	-80.0	-65.5	-49.7	
-20	-6513.6	-7723.7	-9267.6	-11037.3	-12920.9	-14811.3	-16619.3	-18288.5	-19803.3	-21180.3	-22445.8	-23609.0	-20
	-47.7	-68.2	-84.3	-94.4	-98.4	-96.9	-91.5	-83.3	-73.1	-61.2	-47.5	-31.9	
-25	-9293.7	-10250.3	-11537.9	-13045.8	-14660.7	-16280.1	-17824.7	-19248.5	-20540.7	-21716.0	-22793.5	-23775.9	-25
	-32.1	-48.9	-62.0	-70.2	-73.2	-71.5	-66.3	-58.4	-48.5	-36.8	-23.2	-7.8	
-30	-11699.0	-12405.4	-13442.8	-14702.4	-16071.5	-17449.1	-18758.6	-19955.7	-21027.9	-21984.4	-22838.7	-23592.9	-30
	-21.1	-34.2	-44.0	-49.4	-50.3	-47.1	-40.6	-31.6	-20.9	-8.5	5.2	20.2	
-35	-13902.5	-14363.3	-15148.7	-16157.8	-17283.2	-18426.7	-19512.9	-20495.8	-21358.0	-22102.3	-22738.8	-23272.5	-35
	-13.0	-22.9	-29.4	-31.8	-30.0	-24.4	-15.8	-5.0	7.4	20.7	34.6	48.6	
-40	-16112.7	-16330.1	-16854.0	-17596.3	-18460.4	-19356.5	-20213.0	-20983.6	-21647.1	-22201.2	-22653.8	-23014.2	-40
	-5.5	-12.9	-16.6	-16.2	-11.8	-3.8	7.0	19.8	33.6	47.7	61.4	73.9	
-45	-18545.5	-18523.4	-18777.9	-19236.7	-19819.3	-20449.2	-21063.7	-21620.1	-22096.1	-22487.0	-22799.3	-23045.6	-45
	3.6	-1.8	-3.5	-1.1	5.3	15.0	27.2	41.1	55.5	69.6	82.4	93.2	
-50	-21392.5	-21143.7	-21134.3	-21308.8	-21605.0	-21962.9	-22332.5	-22678.0	-22979.7	-23232.5	-23442.3	-23622.8	-50
	15.5	11.5	11.2	14.7	21.8	32.0	44.4	58.1	71.9	85.0	96.3	105.1	
-55	-24782.1	-24334.2	-24086.8	-24000.0	-24029.5	-24132.4	-24272.2	-24422.3	-24567.4	-24703.5	-24836.1	-24978.6	-55
	30.1	27.2	27.6	31.2	38.0	47.4	58.5	70.6	82.7	93.8	103.1	109.9	
-60	-28735.8	-28133.3	-27693.9	-27391.8	-27198.4	-27085.8	-27030.0	-27013.5	-27026.1	-27065.7	-27137.4	-27252.4	-60
	45.9	44.0	44.6	47.7	53.3	60.8	69.7	79.3	88.7	97.3	104.4	109.4	
-65	-33141.2	-32444.4	-31876.8	-31424.0	-31069.9	-30798.7	-30597.0	-30454.8	-30366.9	-30332.7	-30356.7	-30447.6	-65
	60.8	59.7	60.3	62.7	66.6	71.9	78.2	84.8	91.4	97.3	102.2	105.7	
-70	-37767.6	-37051.2	-36433.6	-35908.7	-35469.9	-35110.4	-34824.4	-34607.8	-34458.9	-34378.8	-34370.8	-34440.9	-70
	72.6	72.2	72.7	74.3	76.8	80.0	83.8	87.8	91.8	95.4	98.4	100.6	
-75	-42332.6	-41681.6	-41102.2	-40593.9	-40155.9	-39786.9	-39486.2	-39253.5	-39089.4	-38995.4	-38973.9	-39028.4	-75
	79.8	79.9	80.4	81.4	82.8	84.5	86.4	88.5	90.5	92.3	93.9	95.1	
-80	-46593.2	-46094.6	-45643.2	-45240.9	-44889.5	-44590.4	-44344.9	-44154.3	-44020.0	-43943.2	-43925.6	-43968.6	-80
	81.9	82.3	82.8	83.4	84.1	84.9	85.7	86.5	87.3	88.0	88.6	89.0	
-85	-50417.7	-50145.7	-49898.1	-49676.5	-49482.6	-49317.7	-49182.9	-49079.4	-49008.1	-48969.7	-48964.7	-48993.6	-85
	79.4	79.8	80.1	80.4	80.8	81.0	81.3	81.5	81.7	81.8	81.9	81.9	
-90	-53798.2	-53798.2	-53798.2	-53798.2	-53798.2	-53798.2	-53798.2	-53798.2	-53798.2	-53798.2	-53798.2	-53798.2	-90
	73.3	73.3	73.3	73.3	73.3	73.3	73.3	73.3	73.3	73.3	73.3	73.3	
Lat													Lat
E. Long	300	305	310	315	320	325	330	335	340	345	350	355	E. Long

HORIZONTAL COMPONENT (H) WMM-95

E. Long / Lat	0	5	10	15	20	25	30	35	40	45	50	55	E. Long / Lat
90	2134.8 -8.5	2134.8 -8.5	2134.8 -8.5	2134.8 -8.5	2134.8 -8.5	2134.8 -8.5	2134.8 -8.5	2134.8 -8.5	2134.8 -8.5	2134.8 -8.5	2134.8 -8.5	2134.8 -8.5	90
85	4563.2 -8.1	4578.4 -8.3	4576.9 -8.5	4558.6 -8.6	4523.6 -8.8	4472.0 -8.9	4404.0 -9.0	4319.7 -9.1	4219.7 -9.2	4104.3 -9.3	3974.3 -9.3	3830.5 -9.4	85
80	6796.9 -8.7	6826.9 -9.1	6830.7 -9.4	6808.1 -9.8	6758.9 -10.2	6682.7 -10.5	6579.2 -10.8	6447.6 -11.1	6287.7 -11.3	6099.0 -11.5	5881.4 -11.7	5635.5 -11.9	80
75	8865.7 -7.3	8903.8 -8.0	8913.1 -8.6	8894.0 -9.3	8846.3 -9.9	8769.1 -10.4	8661.1 -11.0	8520.5 -11.5	8345.2 -12.1	8133.1 -12.5	7882.2 -13.0	7591.4 -13.5	75
70	10882.9 -4.6	10916.7 -5.6	10924.6 -6.5	10908.0 -7.4	10867.2 -8.2	10801.5 -9.0	10709.2 -9.7	10587.4 -10.4	10432.8 -11.1	10241.4 -11.7	10009.0 -12.4	9732.4 -13.2	70
65	12951.0 -1.3	12967.8 -2.7	12964.5 -4.0	12944.1 -5.1	12908.2 -6.1	12857.2 -6.9	12789.5 -7.6	12702.4 -8.2	12591.6 -8.8	12452.3 -9.4	12278.9 -10.1	12066.3 -10.9	65
60	15140.8 2.2	15132.0 0.2	15109.4 -1.6	15078.4 -3.1	15042.6 -4.3	15003.6 -5.0	14961.1 -5.5	14912.9 -5.9	14855.3 -6.1	14783.6 -6.4	14692.4 -6.8	14576.1 -7.3	60
55	17489.9 5.6	17454.8 2.7	17411.0 0.3	17366.5 -1.6	17327.2 -2.9	17296.2 -3.6	17274.2 -3.8	17260.1 -3.7	17252.0 -3.6	17247.1 -3.4	17242.3 -3.4	17233.2 -3.6	55
50	20004.5 8.8	19953.8 5.1	19896.7 2.0	19843.9 -0.2	19803.0 -1.6	19777.9 -2.1	19769.9 -2.1	19779.4 -1.8	19807.1 -1.5	19854.7 -1.2	19923.5 -1.0	20012.8 -0.8	50
45	22655.6 11.7	22612.3 7.4	22561.4 4.0	22515.5 1.7	22482.7 0.4	22466.7 -0.1	22468.3 -0.1	22489.2 0.1	22534.3 0.1	22612.0 0.1	22731.1 0.1	22896.0 0.3	45
40	25367.9 14.3	25363.0 9.9	25346.5 6.7	25331.0 4.5	25323.8 3.5	25326.4 3.1	25338.2 2.8	25362.3 2.3	25409.0 1.6	25495.2 0.6	25639.1 -0.1	25852.3 -0.3	40
35	28008.2 16.2	28072.7 12.5	28120.0 9.9	28161.2 8.4	28200.5 7.7	28236.1 7.2	28265.5 6.4	28293.0 4.9	28335.0 2.9	28417.8 0.6	28569.6 -1.2	28809.0 -2.0	35
30	30383.7 17.3	30539.6 14.8	30673.8 13.3	30793.0 12.5	30897.5 12.1	30981.5 11.4	31041.2 9.8	31082.6 7.2	31127.4 3.8	31210.4 0.2	31368.4 -2.6	31625.7 -4.0	30
25	32255.0 17.1	32512.0 16.1	32744.9 15.7	32954.4 15.6	33135.4 15.2	33280.1 14.0	33384.7 11.6	33458.0 8.0	33525.9 3.6	33628.5 -0.7	33808.1 -3.9	34091.5 -5.3	25
20	33369.6 15.2	33725.7 15.6	34058.7 16.0	34360.4 16.0	34620.9 15.2	34832.4 13.3	34994.7 10.2	35120.5 6.2	35238.8 1.7	35391.1 -2.3	35620.1 -4.9	35951.9 -5.5	20
15	33511.6 11.3	33955.5 12.6	34380.4 13.1	34767.2 12.6	35101.9 11.0	35380.0 8.2	35608.2 4.8	35805.2 1.1	36001.5 -2.4	36236.5 -4.8	36548.6 -5.6	36959.1 -4.5	15
10	32561.5 4.6	33070.1 6.2	33566.3 6.3	34020.2 4.7	34415.5 2.0	34753.7 -1.4	35051.2 -4.6	35333.7 -7.2	35632.2 -8.5	35980.7 -8.2	36409.2 -6.2	36930.8 -2.4	10
5	30549.7 -5.3	31079.7 -3.9	31607.4 -4.6	32095.0 -7.2	32527.0 -10.8	32912.5 -14.3	33278.3 -16.6	33656.3 -17.1	34076.3 -15.5	34564.7 -11.9	35139.5 -6.4	35802.3 0.1	5
0	27678.7 -18.6	28161.7 -17.5	28657.3 -18.8	29126.8 -21.9	29559.4 -25.5	29973.0 -28.2	30402.1 -28.8	30881.7 -26.7	31438.0 -21.9	32086.8 -14.7	32831.8 -6.1	33659.8 2.8	0
Lat													Lat
E. Long	0	5	10	15	20	25	30	35	40	45	50	55	E. Long

HORIZONTAL COMPONENT (H) WMM-95

E. Long Lat	60	65	70	75	80	85	90	95	100	105	110	115	E. Long Lat
90	2134.8 -8.5	2134.8 -8.5	2134.8 -8.5	2134.8 -8.5	2134.8 -8.5	2134.8 -8.5	2134.8 -8.5	2134.8 -8.5	2134.8 -8.5	2134.8 -8.5	2134.8 -8.5	2134.8 -8.5	90
85	3673.9 -9.4	3505.7 -9.5	3327.6 -9.6	3141.3 -9.7	2949.0 -9.9	2753.2 -10.1	2556.9 -10.4	2363.3 -10.8	2176.2 -11.3	2000.0 -12.0	1839.1 -12.9	1698.3 -13.9	85
80	5362.1 -12.0	5063.1 -12.2	4741.6 -12.3	4402.1 -12.4	4050.9 -12.7	3697.0 -13.0	3352.5 -13.5	3033.6 -14.2	2761.0 -15.2	2558.4 -16.4	2447.7 -17.6	2440.9 -18.7	80
75	7260.4 -13.9	6890.9 -14.3	6486.8 -14.7	6055.9 -15.2	5610.4 -15.7	5168.7 -16.3	4756.8 -17.1	4408.6 -18.0	4163.6 -19.2	4057.5 -20.4	4109.8 -21.5	4313.3 -22.6	75
70	9409.4 -13.9	9040.7 -14.7	8630.3 -15.6	8188.2 -16.5	7731.2 -17.5	7285.6 -18.6	6887.1 -19.8	6579.9 -21.3	6409.7 -22.8	6411.9 -24.4	6598.2 -26.0	6952.3 -27.6	70
65	11810.6 -11.8	11510.5 -12.9	11168.9 -14.1	10794.8 -15.4	10406.0 -17.0	10030.1 -18.8	9704.9 -20.8	9475.5 -23.1	9386.8 -25.5	9471.8 -28.0	9741.0 -30.4	10177.8 -32.6	65
60	14429.5 -8.1	14248.9 -9.1	14034.0 -10.4	13790.0 -12.1	13529.7 -14.1	13276.0 -16.6	13061.6 -19.6	12926.5 -23.0	12911.6 -26.6	13048.5 -30.2	13349.9 -33.5	13803.9 -36.3	60
55	17214.4 -4.0	17179.8 -4.7	17124.0 -5.7	17045.3 -7.3	16947.8 -9.6	16844.6 -12.7	16758.3 -16.5	16720.3 -21.1	16765.3 -25.9	16923.8 -30.7	17211.9 -34.8	17624.3 -38.1	55
50	20118.0 -0.8	20230.4 -0.9	20338.8 -1.3	20432.5 -2.5	20505.1 -4.7	20557.1 -8.1	20599.0 -12.6	20650.7 -18.1	20739.4 -24.0	20892.9 -29.5	21130.6 -34.2	21454.8 -37.4	50
45	23104.2 0.7	23344.1 1.2	23598.4 1.5	23847.5 0.9	24074.1 -0.9	24266.9 -4.2	24423.3 -9.1	24550.8 -15.1	24667.1 -21.4	24795.4 -27.2	24957.1 -31.7	25161.7 -34.3	45
40	26134.1 0.2	26470.3 1.2	26837.4 2.2	27208.3 2.4	27557.1 1.2	27862.7 -2.0	28110.5 -6.9	28295.8 -12.9	28424.8 -19.1	28514.6 -24.4	28586.1 -27.8	28654.7 -29.0	40
35	29137.2 -1.6	29537.0 -0.2	29979.7 1.4	30432.8 2.2	30865.1 1.4	31248.5 -1.5	31559.3 -6.2	31781.1 -11.8	31908.8 -17.3	31951.3 -21.4	31927.8 -23.1	31857.0 -22.3	35
30	31984.2 -3.6	32423.6 -1.9	32911.2 0.1	33411.5 1.2	33890.8 0.6	34317.5 -2.1	34661.3 -6.4	34896.6 -11.5	35008.5 -15.8	34998.5 -18.2	34882.4 -17.9	34680.9 -15.1	30
25	34479.9 -4.7	34950.0 -2.7	35466.3 -0.5	35991.9 0.8	36492.7 0.1	36935.6 -2.6	37286.9 -6.6	37515.4 -10.9	37600.1 -14.0	37536.9 -14.8	37338.8 -12.7	37027.2 -8.0	25
20	36385.0 -4.1	36893.3 -1.6	37439.5 0.8	37986.4 1.8	38500.1 0.9	38947.0 -1.9	39292.6 -5.6	39504.5 -9.2	39560.0 -11.2	39453.3 -10.7	39195.6 -7.5	38807.8 -2.0	20
15	37462.1 -1.7	38029.0 1.6	38621.8 4.1	39203.5 4.8	39740.0 3.5	40198.0 0.7	40544.0 -2.7	40748.1 -5.5	40790.5 -6.8	40666.2 -5.8	40385.7 -2.5	39969.0 2.6	15
10	37533.5 2.1	38186.4 6.3	38851.7 8.8	39493.3 9.1	40077.4 7.6	40571.2 4.8	40943.9 2.0	41170.5 0.0	41236.0 -0.7	41137.7 0.1	40885.2 2.4	40496.2 5.8	10
5	36533.4 6.5	37299.2 11.3	38063.5 13.7	38792.4 13.7	39453.8 12.0	40016.7 9.7	40454.3 7.8	40747.5 6.7	40886.1 6.4	40868.4 6.6	40701.0 7.2	40398.0 8.0	5
0	34541.0 10.5	35438.7 15.5	36319.0 17.4	37152.6 16.9	37911.7 15.2	38570.1 13.7	39106.8 13.1	39508.7 13.3	39768.6 13.5	39882.9 13.1	39852.3 11.8	39685.2 9.7	0
Lat E. Long	60	65	70	75	80	85	90	95	100	105	110	115	Lat E. Long

HORIZONTAL COMPONENT (H) WMM-95

E. Long	120	125	130	135	140	145	150	155	160	165	170	175	E. Long
Lat													Lat
90	2134.8 -8.5	2134.8 -8.5	2134.8 -8.5	2134.8 -8.5	2134.8 -8.5	2134.8 -8.5	2134.8 -8.5	2134.8 -8.5	2134.8 -8.5	2134.8 -8.5	2134.8 -8.5	2134.8 -8.5	90
85	1582.0 -15.1	1493.5 -16.2	1434.1 -17.3	1402.5 -18.3	1395.0 -19.0	1405.6 -19.5	1427.5 -19.8	1454.1 -20.0	1479.6 -20.1	1499.2 -20.1	1509.2 -20.2	1506.7 -20.2	85
80	2532.9 -19.4	2704.0 -20.0	2927.5 -20.5	3178.1 -20.9	3435.1 -21.3	3682.8 -21.7	3909.5 -22.1	4106.8 -22.4	4268.8 -22.6	4391.2 -22.7	4471.3 -22.8	4507.3 -22.6	80
75	4638.2 -23.6	5044.3 -24.6	5492.5 -25.6	5950.1 -26.6	6391.9 -27.6	6799.3 -28.5	7159.1 -29.3	7462.2 -29.8	7702.8 -30.2	7877.5 -30.3	7984.7 -30.2	8023.9 -29.8	75
70	7435.8 -29.1	8001.1 -30.6	8602.0 -32.0	9199.3 -33.3	9762.3 -34.5	10269.1 -35.4	10704.9 -36.0	11061.2 -36.4	11333.5 -36.4	11520.9 -36.2	11624.1 -35.7	11644.9 -34.9	70
65	10743.7 -34.5	11388.8 -36.2	12062.2 -37.6	12719.4 -38.7	13325.8 -39.4	13857.3 -39.7	14299.9 -39.7	14647.1 -39.2	14898.4 -38.4	15056.9 -37.4	15127.2 -36.2	15114.3 -34.9	65
60	14376.0 -38.5	15017.9 -40.1	15677.5 -41.0	16307.8 -41.3	16873.0 -41.0	17349.5 -40.1	17725.9 -38.7	18000.3 -36.9	18177.6 -34.8	18266.3 -32.7	18276.0 -30.7	18215.0 -28.8	60
55	18133.7 -40.3	18696.5 -41.3	19262.9 -41.3	19787.0 -40.4	20234.2 -38.6	20584.0 -36.1	20829.7 -33.0	20975.2 -29.6	21031.2 -26.1	21012.2 -22.8	20932.7 -19.9	20805.1 -17.6	55
50	21847.0 -39.1	22270.8 -39.3	22681.5 -38.1	23037.1 -35.8	23307.0 -32.6	23475.6 -28.6	23541.8 -24.0	23515.5 -19.2	23413.2 -14.5	23254.2 -10.2	23057.6 -6.6	22840.1 -4.0	50
45	25399.9 -34.9	25644.2 -33.9	25857.0 -31.5	26002.2 -28.1	26055.3 -23.9	26007.2 -19.1	25863.2 -13.8	25638.5 -8.4	25354.2 -3.1	25033.4 1.6	24698.6 5.5	24370.3 8.2	45
40	28719.8 -28.1	28763.1 -25.7	28755.3 -22.2	28668.1 -18.2	28484.7 -13.9	28203.7 -9.4	27837.1 -4.7	27405.5 0.1	26933.1 4.8	26445.2 9.1	25966.4 12.8	25519.9 15.4	40
35	31746.0 -19.5	31585.3 -15.6	31354.1 -11.4	31033.0 -7.5	30614.3 -4.2	30105.1 -1.3	29524.6 1.5	28898.2 4.3	28252.6 7.3	27614.0 10.3	27007.2 13.2	26455.5 15.6	35
30	34406.6 -10.4	34057.6 -5.2	33621.6 -0.8	33088.4 2.2	32459.8 3.8	31751.8 4.2	30990.3 4.1	30204.8 4.0	29423.7 4.3	28672.7 5.2	27974.7 6.8	27350.8 8.8	30
25	36618.3 -2.0	36116.3 3.8	35516.7 7.9	34818.1 9.7	34031.2 9.2	33179.8 6.9	32294.9 3.6	31408.6 0.3	30549.3 -2.4	29740.8 -3.9	29002.3 -4.0	28350.0 -2.7	25
20	38308.4 4.4	37706.2 9.9	37003.5 13.3	36207.2 13.8	35335.2 11.5	34416.2 7.0	33483.9 1.2	32570.1 -4.7	31701.3 -10.1	30897.6 -13.9	30172.5 -15.7	29535.7 -15.3	20
15	39435.3 8.1	38797.2 12.6	38063.4 14.8	37247.5 14.1	36372.7 10.8	35469.7 5.3	34570.9 -1.5	33705.2 -8.9	32894.8 -15.7	32154.1 -21.3	31489.9 -24.7	30904.6 -25.5	15
10	39990.0 9.2	39382.7 11.7	38689.2 12.4	37928.9 11.0	37127.8 7.7	36315.6 2.7	35520.7 -3.6	34766.6 -10.6	34069.7 -17.6	33437.4 -23.9	32868.8 -28.5	32359.0 -30.7	10
5	39978.1 8.5	39460.9 8.4	38867.7 7.5	38222.9 5.7	37553.7 3.2	36886.4 -0.1	36243.7 -4.4	35642.8 -9.6	35093.3 -15.5	34595.9 -21.5	34142.6 -26.7	33720.9 -30.2	5
0	39398.7 7.1	39016.2 4.3	38565.0 1.8	38074.2 -0.1	37570.7 -1.4	37076.9 -2.4	36608.9 -4.0	36177.5 -6.6	35786.9 -10.5	35432.2 -15.5	35099.1 -20.7	34769.0 -25.4	0
Lat													Lat
E. Long	120	125	130	135	140	145	150	155	160	165	170	175	E. Long

HORIZONTAL COMPONENT (H) WMM-95

E. Long	180	185	190	195	200	205	210	215	220	225	230	235	E. Long
Lat													Lat
90	2134.8 -8.5	2134.8 -8.5	2134.8 -8.5	2134.8 -8.5	2134.8 -8.5	2134.8 -8.5	2134.8 -8.5	2134.8 -8.5	2134.8 -8.5	2134.8 -8.5	2134.8 -8.5	2134.8 -8.5	90
85	1490.0 -20.3	1457.8 -20.4	1409.7 -20.6	1346.1 -20.8	1267.8 -21.2	1176.8 -21.6	1076.1 -22.3	970.7 -23.0	868.2 -23.9	780.7 -24.6	725.3 -24.3	720.5 -22.5	85
80	4498.3 -22.4	4444.3 -22.1	4345.5 -21.6	4202.7 -21.0	4017.3 -20.3	3790.8 -19.6	3525.0 -18.7	3222.3 -17.8	2885.2 -16.9	2516.6 -16.0	2119.6 -15.1	1698.0 -14.4	80
75	7995.5 -29.3	7900.4 -28.5	7739.8 -27.5	7515.3 -26.2	7228.6 -24.8	6881.7 -23.1	6476.9 -21.2	6017.2 -19.1	5505.9 -16.8	4947.1 -14.3	4346.0 -11.4	3708.9 -8.1	75
70	11585.6 -33.9	11447.8 -32.6	11233.2 -31.1	10942.7 -29.3	10577.5 -27.3	10138.6 -24.9	9627.6 -22.1	9046.9 -19.1	8400.0 -15.6	7692.3 -11.8	6931.1 -7.6	6126.6 -2.9	70
65	15022.2 -33.5	14853.1 -32.0	14608.0 -30.3	14286.2 -28.3	13886.4 -26.1	13407.0 -23.4	12847.5 -20.3	12208.2 -16.6	11491.8 -12.6	10703.7 -8.1	9852.5 -3.2	8951.5 2.1	65
60	18089.6 -27.2	17902.5 -25.7	17653.5 -24.3	17339.6 -22.9	16955.9 -21.1	16497.0 -18.8	15958.1 -16.0	15336.5 -12.5	14631.9 -8.5	13848.1 -4.1	12992.9 0.5	12080.1 5.2	60
55	20638.4 -16.0	20436.7 -15.0	20199.4 -14.4	19921.6 -14.0	19594.9 -13.4	19209.2 -12.3	18754.3 -10.5	18222.1 -8.0	17607.8 -4.9	16910.8 -1.4	16135.9 2.1	15293.6 5.4	55
50	22614.3 -2.5	22387.3 -2.2	22160.2 -2.7	21927.5 -3.6	21678.5 -4.6	21398.3 -5.2	21070.5 -5.1	20679.9 -4.2	20215.0 -2.6	19669.2 -0.6	19041.5 1.3	18336.9 2.7	50
45	24065.4 9.5	23795.3 9.3	23564.6 7.9	23369.5 5.7	23198.2 3.2	23031.7 0.8	22847.3 -0.9	22622.3 -1.9	22337.3 -2.1	21978.4 -1.9	21538.2 -1.7	21014.9 -2.1	45
40	25125.9 16.7	24800.1 16.4	24551.4 14.8	24379.0 12.0	24271.2 8.5	24206.4 4.8	24156.3 1.5	24091.5 -1.2	23985.7 -3.1	23818.7 -4.7	23576.5 -6.1	23250.9 -8.0	40
35	25980.6 17.1	25600.8 17.4	25328.2 16.4	25165.0 13.9	25100.5 10.4	25111.7 6.3	25167.1 2.1	25233.0 -1.8	25279.1 -5.3	25281.1 -8.3	25220.5 -11.1	25083.1 -14.2	35
30	26820.8 10.8	26402.7 12.2	26110.3 12.5	25947.3 11.4	25904.2 9.0	25958.2 5.4	26077.5 1.1	26228.4 -3.5	26380.3 -8.0	26508.2 -12.2	26591.5 -16.2	26611.1 -20.0	30
25	27799.3 -0.3	27365.6 2.3	27061.7 4.4	26891.9 5.3	26847.5 4.7	26907.5 2.4	27043.4 -1.3	27225.4 -5.9	27426.9 -11.1	27625.1 -16.2	27799.4 -20.9	27927.8 -25.2	25
20	28996.9 -13.0	28567.3 -9.5	28257.5 -5.8	28071.4 -2.8	28001.4 -1.5	28030.3 -2.1	28135.3 -4.7	28293.8 -9.0	28485.5 -14.3	28692.5 -20.0	28896.0 -25.3	29073.3 -29.8	20
15	30401.4 -23.8	29987.3 -20.1	29670.6 -15.6	29454.8 -11.3	29334.8 -8.4	29298.3 -7.5	29330.0 -8.9	29415.5 -12.6	29541.8 -17.8	29696.6 -23.6	29865.1 -29.1	30026.7 -33.6	15
10	31905.1 -30.2	31510.0 -27.5	31180.4 -23.3	30920.7 -18.8	30729.8 -15.1	30601.7 -13.3	30528.4 -13.8	30502.8 -16.6	30518.4 -21.2	30568.8 -26.7	30644.9 -32.1	30732.0 -36.3	10
5	33322.2 -31.6	32945.9 -30.6	32598.0 -28.0	32285.8 -24.4	32013.2 -21.2	31780.7 -19.1	31586.8 -18.9	31429.8 -20.8	31308.2 -24.4	31220.9 -29.1	31166.0 -33.7	31137.4 -37.4	5
0	34427.9 -28.7	34072.0 -30.2	33707.7 -29.9	33345.6 -28.3	32995.6 -26.3	32664.5 -24.6	32355.7 -24.0	32070.9 -24.8	31811.8 -27.0	31581.7 -30.2	31385.5 -33.7	31226.3 -36.6	0
Lat													Lat
E. Long	180	185	190	195	200	205	210	215	220	225	230	235	E. Long

HORIZONTAL COMPONENT (H) WMM-95

E. Long Lat	240	245	250	255	260	265	270	275	280	285	290	295	E. Long Lat
90	2134.8 -8.5	2134.8 -8.5	2134.8 -8.5	2134.8 -8.5	2134.8 -8.5	2134.8 -8.5	2134.8 -8.5	2134.8 -8.5	2134.8 -8.5	2134.8 -8.5	2134.8 -8.5	2134.8 -8.5	90
85	776.3 -19.1	888.1 -15.5	1042.5 -12.3	1226.0 -10.0	1428.6 -8.3	1643.1 -7.2	1864.3 -6.5	2088.5 -6.0	2312.6 -5.7	2534.0 -5.6	2750.6 -5.6	2960.4 -5.6	85
80	1255.8 -14.1	798.6 -14.7	341.7 -20.1	226.3 -12.6	680.1 0.1	1164.3 1.6	1648.9 1.6	2127.1 1.1	2594.4 0.5	3046.9 -0.2	3481.2 -0.9	3894.5 -1.7	80
75	3044.0 -4.2	2364.0 1.0	1692.7 9.0	1097.8 23.1	822.0 39.9	1140.2 33.8	1747.6 24.1	2422.5 17.8	3103.6 13.6	3768.3 10.4	4404.7 7.9	5005.2 5.8	75
70	5293.9 2.6	4456.4 9.3	3653.0 17.7	2955.3 28.3	2490.7 39.7	2416.7 45.8	2762.0 43.0	3383.5 36.5	4132.7 30.0	4921.4 24.5	5701.8 20.0	6446.8 16.2	70
65	8020.6 7.8	7089.7 14.2	6204.0 21.6	5432.2 29.9	4869.6 38.5	4620.6 45.2	4741.9 47.8	5194.3 46.1	5873.2 41.8	6671.6 36.7	7509.0 31.6	8331.6 26.8	65
60	11130.4 10.0	10175.1 14.9	9259.4 20.3	8446.5 26.4	7816.3 33.0	7453.0 39.4	7415.2 44.4	7703.9 46.7	8260.0 46.2	8992.8 43.6	9812.8 39.6	10648.0 35.0	60
55	14402.0 8.4	13489.1 11.2	12596.2 14.3	11780.0 18.1	11111.4 23.1	10666.4 29.2	10505.8 35.6	10651.4 40.9	11074.5 44.1	11706.5 44.7	12462.7 43.0	13263.8 39.6	55
50	17567.9 3.7	16756.4 4.2	15936.8 4.9	15159.0 6.6	14487.4 10.1	13993.6 15.8	13741.3 23.2	13766.1 30.9	14061.6 37.4	14580.1 41.3	15248.3 42.4	15987.6 41.1	50
45	20413.6 -3.1	19748.2 -4.6	19045.0 -5.9	18345.8 -6.1	17708.4 -4.0	17200.8 1.1	16888.4 9.0	16816.9 18.5	16997.0 27.7	17400.6 34.8	17969.2 38.9	18631.1 40.1	45
40	22838.9 -10.5	22345.5 -13.5	21787.2 -16.3	21196.5 -17.9	20623.7 -17.1	20132.1 -12.9	19787.1 -5.1	19641.2 5.3	19718.6 16.5	20009.2 26.4	20471.6 33.5	21045.6 37.6	40
35	24858.1 -17.6	24540.6 -21.4	24136.2 -25.0	23666.9 -27.6	23173.8 -27.9	22714.4 -24.8	22352.5 -17.8	22144.9 -7.3	22127.1 4.9	22305.1 16.9	22655.1 26.8	23131.9 33.7	35
30	26548.8 -23.8	26389.5 -27.7	26127.4 -31.5	25772.5 -34.5	25355.9 -35.7	24927.7 -33.9	24549.5 -28.3	24281.4 -18.8	24168.6 -6.5	24231.6 6.6	24463.9 18.6	24836.3 28.2	30
25	27985.7 -29.0	27948.8 -32.6	27799.7 -36.0	27536.5 -38.9	27178.6 -40.7	26768.2 -40.2	26363.8 -36.4	26028.7 -28.7	25817.3 -17.5	25763.7 -4.3	25877.0 9.0	26143.3 20.6	25
20	29195.9 -33.4	29232.9 -36.3	29157.2 -38.8	28955.1 -41.2	28633.8 -43.2	28225.7 -44.0	27785.3 -42.3	27378.4 -37.0	27068.5 -27.9	26902.4 -15.7	26902.6 -2.3	27067.5 10.4	20
15	30153.4 -36.8	30211.6 -38.8	30168.0 -40.4	29998.3 -42.1	29697.0 -44.0	29284.8 -45.8	28809.1 -46.1	28336.3 -43.5	27937.3 -37.2	27670.4 -27.1	27569.2 -14.8	27640.8 -2.4	15
10	30807.1 -39.0	30839.1 -40.3	30792.4 -40.9	30634.8 -41.9	30348.0 -43.6	29938.1 -46.0	29441.7 -48.0	28921.3 -48.1	28451.9 -44.9	28100.8 -37.8	27910.6 -27.7	27893.6 -16.7	10
5	31120.8 -39.6	31092.0 -40.3	31017.6 -40.4	30860.2 -40.8	30589.8 -42.2	30196.6 -44.9	29701.9 -48.2	29158.7 -50.6	28640.7 -50.4	28220.4 -46.7	27947.4 -39.7	27837.4 -31.2	5
0	31100.5 -38.4	30992.9 -39.0	30875.3 -38.9	30709.2 -39.0	30455.7 -40.2	30089.8 -43.0	29614.8 -47.0	29069.1 -51.0	28518.8 -53.4	28037.2 -52.8	27678.7 -49.2	27463.0 -43.8	0
Lat E. Long	240	245	250	255	260	265	270	275	280	285	290	295	Lat E. Long

HORIZONTAL COMPONENT (H) WMM-95

E. Long	300	305	310	315	320	325	330	335	340	345	350	355	E. Long
Lat 90	2134.8 -8.5	2134.8 -8.5	2134.8 -8.5	2134.8 -8.5	2134.8 -8.5	2134.8 -8.5	2134.8 -8.5	2134.8 -8.5	2134.8 -8.5	2134.8 -8.5	2134.8 -8.5	2134.8 -8.5	Lat 90
85	3162.0 -5.7	3353.7 -5.9	3534.5 -6.1	3703.1 -6.3	3858.8 -6.5	4000.6 -6.7	4127.9 -6.9	4240.2 -7.1	4337.0 -7.3	4418.0 -7.6	4482.8 -7.8	4531.3 -8.0	85
80	4284.3 -2.4	4648.6 -3.0	4985.9 -3.7	5295.3 -4.3	5575.9 -4.9	5827.6 -5.4	6050.3 -5.9	6244.2 -6.4	6409.7 -6.9	6547.2 -7.4	6657.3 -7.8	6740.4 -8.2	80
75	5564.6 4.0	6079.5 2.4	6547.9 1.0	6969.1 -0.2	7343.4 -1.3	7671.9 -2.2	7956.5 -3.1	8199.1 -3.9	8402.2 -4.6	8568.3 -5.3	8699.5 -6.0	8798.1 -6.7	75
70	7140.2 12.9	7772.8 10.1	8340.0 7.8	8840.5 5.8	9275.3 4.1	9647.6 2.7	9961.3 1.4	10221.3 0.3	10432.4 -0.7	10599.7 -1.7	10727.8 -2.7	10820.9 -3.7	70
65	9105.5 22.4	9810.3 18.6	10435.8 15.4	10978.6 12.7	11439.9 10.5	11824.5 8.6	12138.9 7.1	12390.1 5.7	12585.9 4.4	12733.2 3.0	12839.1 1.6	12909.8 0.2	65
60	11447.3 30.3	12178.0 26.0	12822.5 22.3	13374.0 19.3	13833.7 16.9	14207.4 14.9	14503.4 13.3	14730.8 11.8	14898.8 10.2	15015.9 8.4	15090.1 6.5	15129.2 4.4	60
55	14046.9 35.6	14768.7 31.5	15404.5 27.9	15944.0 25.0	16387.3 22.9	16741.0 21.2	17014.5 19.8	17217.9 18.3	17360.6 16.5	17451.0 14.2	17497.1 11.6	17507.1 8.6	55
50	16729.3 38.3	17423.0 35.1	18037.7 32.2	18559.7 30.0	18987.8 28.5	19328.6 27.4	19591.7 26.3	19786.8 24.9	19922.1 22.9	20004.3 20.1	20040.1 16.6	20037.0 12.7	50
45	19317.8 39.3	19975.1 37.6	20567.7 35.9	21079.0 34.6	21506.1 33.9	21854.4 33.4	22132.4 32.6	22347.7 31.1	22505.7 28.7	22610.4 25.3	22665.7 21.1	22677.6 16.4	45
40	21668.2 39.1	22285.4 39.3	22860.3 39.0	23373.8 38.9	23820.8 38.9	24204.1 38.7	24528.7 37.9	24798.3 36.1	25014.2 33.2	25176.2 29.2	25285.5 24.4	25346.4 19.2	40
35	23682.1 37.8	24256.4 40.1	24818.5 41.4	25347.6 42.2	25835.2 42.7	26279.6 42.5	26679.7 41.3	27032.9 38.8	27335.0 35.2	27582.2 30.7	27773.6 25.8	27912.8 20.8	35
30	25307.9 34.9	25836.6 39.2	26388.7 41.9	26941.8 43.4	27482.6 43.9	28002.2 43.2	28491.2 41.3	28939.4 38.2	29337.1 34.0	29678.4 29.4	29962.9 24.9	30195.1 20.7	30
25	26533.8 29.4	27014.7 35.5	27554.7 39.1	28128.9 40.9	28717.2 41.0	29301.8 39.7	29864.7 37.1	30389.2 33.3	30862.9 29.1	31281.5 25.0	31647.7 21.5	31969.4 18.9	25
20	27378.1 20.6	27806.5 27.7	28322.2 31.8	28895.5 33.4	29498.2 33.0	30103.9 31.1	30688.7 27.9	31234.9 24.2	31733.6 20.6	32186.6 17.7	32603.6 15.9	32995.7 15.2	20
15	27871.6 8.2	28235.1 15.6	28698.7 19.6	29225.9 20.7	29780.1 19.7	30329.3 17.3	30850.7 14.2	31334.0 11.2	31782.4 9.0	32209.7 8.0	32633.7 8.3	33067.2 9.6	15
10	28037.0 -7.0	28311.9 -0.2	28679.9 3.2	29097.2 3.6	29521.2 1.9	29919.1 -0.6	30277.2 -3.1	30602.6 -4.7	30918.4 -5.0	31254.5 -3.8	31636.3 -1.3	32074.9 1.8	10
5	27876.2 -23.3	28029.5 -17.9	28252.2 -15.6	28494.3 -16.1	28710.8 -18.2	28874.2 -20.6	28985.8 -22.2	29075.8 -22.3	29191.2 -20.5	29378.4 -17.2	29667.9 -12.9	30065.4 -8.5	5
0 Lat	27374.9 -38.6	27375.4 -35.2	27413.5 -34.4	27436.1 -35.8	27400.0 -38.3	27286.6 -40.5	27114.0 -41.2	26934.2 -40.0	26814.3 -36.8	26813.3 -32.1	26963.0 -26.8	27262.1 -21.9	0 Lat
E. Long	300	305	310	315	320	325	330	335	340	345	350	355	E. Long

HORIZONTAL COMPONENT (H) WMM-95

E. Long / Lat	0	5	10	15	20	25	30	35	40	45	50	55	Lat / E. Long
0	27678.7 -18.6	28161.7 -17.5	28657.3 -18.8	29126.8 -21.9	29559.4 -25.5	29973.0 -28.2	30402.1 -28.8	30881.7 -26.7	31438.0 -21.9	32086.8 -14.7	32831.8 -6.1	33659.8 2.8	0
-5	24295.9 -34.9	24646.6 -33.9	25030.1 -34.9	25417.1 -37.3	25807.0 -39.6	26225.2 -40.4	26709.2 -38.6	27292.0 -33.6	27992.3 -25.7	28813.4 -15.6	29741.9 -4.6	30746.6 5.7	-5
-10	20816.3 -53.0	20957.3 -51.3	21156.1 -50.9	21403.1 -51.0	21711.8 -50.6	22113.3 -48.5	22642.3 -43.7	23324.0 -35.9	24166.4 -25.6	25157.8 -13.6	26264.9 -1.6	27436.0 8.6	-10
-15	17618.2 -70.4	17514.8 -67.5	17496.2 -64.5	17578.4 -61.1	17790.8 -56.9	18166.9 -51.0	18734.0 -43.1	19505.8 -32.9	20477.0 -20.9	21617.9 -8.2	22873.2 3.3	24170.2 11.6	-15
-20	14962.2 -84.4	14645.4 -79.5	14439.8 -73.3	14385.3 -66.0	14523.6 -57.5	14887.7 -47.9	15495.9 -37.0	16348.8 -24.9	17425.2 -12.1	18674.8 -0.1	20019.5 9.2	21369.4 14.3	-20
-25	12969.8 -92.3	12530.3 -85.1	12227.5 -75.7	12114.4 -64.7	12237.9 -52.7	12627.4 -39.9	13291.7 -26.7	14218.0 -13.5	15366.4 -1.1	16665.0 8.8	18017.8 14.7	19326.4 15.7	-25
-30	11666.4 -92.7	11219.6 -83.2	10932.8 -71.3	10859.1 -57.7	11041.1 -43.3	11500.6 -28.7	12236.3 -14.6	13220.5 -1.6	14395.0 8.9	15671.7 15.7	16946.9 17.6	18124.6 14.6	-30
-35	11042.7 -85.9	10685.2 -74.7	10504.4 -61.4	10543.6 -46.7	10833.6 -31.7	11385.1 -17.0	12184.5 -3.7	13191.0 7.4	14334.1 14.9	15520.7 18.1	16651.1 16.5	17639.9 10.5	-35
-40	11084.3 -73.5	10864.9 -61.7	10826.9 -48.3	10998.9 -34.2	11397.0 -20.3	12019.6 -7.5	12842.2 3.5	13815.9 11.5	14868.1 15.8	15911.6 15.9	16858.9 11.8	17638.4 4.4	-40
-45	11755.1 -58.0	11669.5 -46.7	11755.8 -34.7	12027.9 -22.6	12489.1 -11.2	13127.1 -1.3	13911.2 6.4	14791.6 11.2	15701.9 12.6	16567.7 10.6	17317.3 5.4	17892.7 -1.9	-45
-50	12959.6 -41.9	12966.1 -32.3	13123.0 -22.6	13433.2 -13.3	13890.5 -5.1	14476.8 1.6	15160.4 6.1	15896.2 8.3	16629.1 7.7	17299.6 4.7	17851.8 -0.3	18239.4 -6.5	-50
-55	14518.8 -27.7	14564.3 -20.2	14731.5 -13.1	15016.3 -6.7	15407.8 -1.5	15886.5 2.4	16423.9 4.6	16982.9 4.9	17520.9 3.5	17992.8 0.6	18356.2 -3.3	18574.7 -7.7	-55
-60	16184.6 -16.6	16226.5 -11.2	16358.5 -6.3	16573.5 -2.3	16859.7 0.8	17199.5 2.7	17569.7 3.5	17942.2 3.2	18285.8 1.8	18567.9 -0.2	18757.0 -2.7	18825.2 -5.1	-60
-65	17686.4 -8.7	17701.7 -4.8	17776.5 -1.6	17903.4 1.0	18071.9 2.8	18267.9 3.9	18474.4 4.2	18671.4 4.0	18837.3 3.3	18949.4 2.4	18985.8 1.4	18925.9 0.6	-65
-70	18784.7 -2.9	18768.1 -0.1	18783.7 2.2	18825.6 4.0	18885.7 5.4	18954.1 6.3	19019.2 6.9	19067.9 7.2	19086.3 7.3	19060.0 7.4	18974.8 7.5	18817.2 7.8	-70
-75	19300.1 2.2	19257.5 4.2	19225.2 5.9	19199.3 7.4	19174.7 8.7	19145.5 9.8	19104.8 10.7	19045.1 11.5	18958.7 12.3	18837.4 13.0	18673.7 13.8	18460.1 14.7	-75
-80	19112.1 7.5	19056.8 8.9	18997.3 10.1	18931.8 11.3	18858.0 12.4	18773.2 13.5	18674.6 14.5	18559.0 15.5	18423.2 16.4	18264.0 17.3	18078.6 18.3	17864.4 19.2	-80
-85	18150.9 13.4	18104.8 14.1	18050.1 14.7	17986.7 15.4	17914.1 16.1	17831.9 16.7	17739.9 17.4	17637.5 18.1	17524.5 18.7	17400.6 19.3	17265.6 20.0	17119.6 20.6	-85
-90	16415.2 19.4	16415.2 19.4	16415.2 19.4	16415.2 19.4	16415.2 19.4	16415.2 19.4	16415.2 19.4	16415.2 19.4	16415.2 19.4	16415.2 19.4	16415.2 19.4	16415.2 19.4	-90
Lat / E. Long	0	5	10	15	20	25	30	35	40	45	50	55	Lat / E. Long

HORIZONTAL COMPONENT (H) WMM-95

E. Long	60	65	70	75	80	85	90	95	100	105	110	115	E. Long
Lat 0	34541.0 10.5	35438.7 15.5	36319.0 17.4	37152.6 16.9	37911.7 15.2	38570.1 13.7	39106.8 13.1	39508.7 13.3	39768.6 13.5	39882.9 13.1	39852.3 11.8	39685.2 9.7	Lat 0
-5	31785.0 13.5	32816.5 17.8	33810.4 18.7	34744.2 17.4	35598.5 15.8	36355.6 15.3	37002.9 16.4	37533.9 18.2	37943.1 19.4	38222.0 18.8	38362.1 16.0	38363.8 11.5	-5
-10	28614.6 15.2	29755.5 17.7	30832.3 16.9	31831.9 14.5	32746.5 12.9	33571.2 13.4	34305.3 16.2	34950.6 20.0	35503.4 22.7	35948.9 22.6	36267.7 19.4	36448.9 13.6	-10
-15	25439.5 15.6	26633.3 15.3	27730.8 12.0	28729.9 8.2	29637.0 6.3	30462.8 7.7	31222.3 12.1	31928.4 17.9	32581.3 22.4	33161.7 23.8	33638.6 21.3	33987.7 15.7	-15
-20	22647.7 14.6	23808.3 10.7	24838.4 4.7	25747.3 -0.7	26555.8 -3.1	27291.4 -1.3	27986.4 4.3	28668.4 11.8	29346.0 18.3	29998.9 21.7	30586.9 21.1	31071.4 17.1	-20
-25	20515.0 11.9	21544.9 4.6	22412.4 -3.9	23137.1 -10.8	23751.8 -14.0	24299.0 -12.2	24828.1 -6.1	25384.1 2.4	25988.9 10.6	26628.1 16.2	27257.3 18.2	27825.0 16.9	-25
-30	19138.0 7.3	19958.0 -2.5	20588.9 -12.6	21057.0 -20.5	21402.7 -24.3	21678.9 -23.0	21948.9 -17.2	22275.6 -8.5	22699.8 0.6	23221.7 8.0	23801.4 12.5	24380.4 14.2	-30
-35	18431.8 1.3	19005.9 -9.6	19370.5 -19.9	19553.1 -27.8	19595.3 -31.9	19553.1 -31.4	19497.8 -26.7	19507.0 -19.0	19644.1 -10.1	19933.8 -2.0	20354.3 4.4	20851.4 8.7	-35
-40	18205.1 -5.2	18542.4 -15.4	18657.3 -24.7	18572.5 -31.6	18324.1 -35.3	17962.9 -35.4	17558.0 -32.2	17193.7 -26.4	16953.5 -19.2	16895.2 -11.8	17031.2 -4.9	17330.1 0.8	-40
-45	18256.6 -10.5	18393.0 -18.9	18303.3 -26.1	18001.7 -31.2	17513.2 -33.9	16876.5 -34.2	16148.1 -32.2	15405.2 -28.7	14738.6 -24.1	14235.6 -19.0	13956.3 -13.6	13917.1 -8.2	-45
-50	18430.6 -13.0	18407.8 -19.0	18166.0 -23.7	17709.4 -26.7	17051.0 -28.0	16214.1 -27.8	15236.6 -26.5	14175.4 -24.7	13107.3 -22.7	12125.4 -20.7	11326.5 -18.4	10792.0 -15.6	-50
-55	18620.5 -11.9	18475.2 -15.3	18128.3 -17.7	17576.3 -18.7	16822.2 -18.5	15876.4 -17.5	14759.1 -16.2	13503.2 -15.0	12156.9 -14.3	10786.1 -14.5	9476.9 -15.5	8336.3 -16.8	-55
-60	18749.2 -7.2	18511.2 -8.5	18098.5 -8.9	17503.6 -8.5	16723.9 -7.2	15761.9 -5.5	14626.5 -3.8	13333.7 -2.3	11907.4 -1.6	10379.8 -1.8	8792.8 -3.3	7201.1 -6.2	-60
-65	18752.0 0.2	18448.9 0.3	18005.5 1.1	17413.6 2.4	16669.4 4.1	15772.8 6.1	14728.2 8.2	13544.3 9.9	12234.5 11.2	10816.3 11.9	9310.2 11.9	7739.2 11.2	-65
-70	18575.1 8.4	18238.4 9.4	17799.0 10.6	17251.4 12.1	16592.9 13.9	15824.0 15.8	14948.3 17.6	13972.9 19.3	12908.5 20.8	11769.3 21.9	10573.3 22.8	9342.6 23.4	-70
-75	18190.3 15.6	17858.9 16.8	17462.0 18.0	16997.2 19.4	16464.1 20.8	15864.4 22.2	15201.8 23.6	14482.6 24.9	13715.5 26.1	12911.8 27.1	12085.5 28.0	11253.4 28.7	-75
-80	17619.2 20.1	17341.6 21.1	17030.8 22.1	16686.9 23.0	16311.1 24.0	15905.5 24.9	15473.3 25.8	15019.0 26.7	14548.1 27.4	14067.5 28.1	13584.8 28.7	13108.8 29.2	-80
-85	16962.7 21.2	16795.4 21.8	16618.3 22.3	16432.3 22.9	16238.5 23.4	16038.5 23.9	15833.9 24.3	15626.7 24.7	15419.3 25.1	15213.9 25.4	15013.3 2	14820.1 26.0	-85
-90	16415.2 19.4	16415.2 19.4	16415.2 19.4	16415.2 19.4	16415.2 19.4	16415.2 19.4	16415.2 19.4	16415.2 19.4	16415.2 19.4	16415.2 19.4	16415.2 19.4	16415.2 19.4	-90
Lat													Lat
E. Long	60	65	70	75	80	85	90	95	100	105	110	115	E. Long

E. Long Lat	120	125	130	135	140	145	150	155	160	165	170	175	E. Long Lat
0	39398.7 7.1	39016.2 4.3	38565.0 1.8	38074.2 -0.1	37570.7 -1.4	37076.9 -2.4	36608.9 -4.0	36177.5 -6.6	35786.9 -10.5	35432.2 -15.5	35099.1 -20.7	34769.0 -25.4	0
-5	38240.7 6.2	38018.9 1.1	37731.3 -2.7	37410.7 -4.7	37083.8 -4.8	36768.4 -3.9	36475.1 -2.8	36209.4 -2.9	35971.2 -4.6	35752.1 -8.3	35533.9 -13.2	35293.6 -18.7	-5
-10	36500.2 6.7	36447.5 0.2	36327.0 -4.6	36174.3 -6.7	36016.1 -6.3	35867.1 -4.1	35733.5 -1.4	35616.9 0.2	35514.8 0.0	35417.2 -2.5	35304.4 -7.0	35151.4 -12.9	-10
-15	34206.6 8.6	34316.4 1.8	34353.0 -3.3	34353.3 -5.6	34344.2 -5.2	34339.5 -3.0	34343.3 -0.2	34355.1 1.9	34371.2 2.2	34381.4 0.3	34366.4 -3.9	34301.4 -9.8	-15
-20	31435.5 11.3	31690.2 5.3	31865.7 0.7	31997.6 -1.8	32113.7 -2.1	32228.7 -0.8	32347.4 0.9	32469.0 2.1	32589.3 1.8	32698.6 -0.3	32778.9 -4.3	32807.1 -10.0	-20
-25	28297.7 13.4	28670.5 9.4	28963.1 5.8	29205.8 3.4	29426.0 2.3	29641.0 2.0	29857.9 1.9	30077.0 1.3	30294.3 -0.2	30500.5 -3.0	30679.0 -7.1	30808.8 -12.4	-25
-30	24909.4 13.7	25365.0 12.1	25751.3 10.1	26088.7 8.3	26401.5 6.6	26707.8 4.8	27016.9 2.8	27331.0 0.4	27646.1 -2.5	27952.6 -6.0	28235.2 -10.2	28475.2 -15.2	-30
-35	21366.1 11.0	21857.7 12.0	22311.4 12.0	22733.0 11.1	23137.8 9.4	23540.6 6.9	23950.0 3.7	24367.9 0.1	24789.6 -3.7	25204.9 -7.7	25599.1 -11.8	25955.4 -16.3	-35
-40	17737.5 5.2	18201.3 8.3	18687.7 10.1	19182.7 10.6	19686.0 9.7	20201.4 7.5	20730.9 4.3	21271.8 0.6	21816.6 -3.3	22353.4 -7.1	22868.0 -10.9	23345.2 -14.8	-40
-45	14093.4 -3.1	14438.0 1.3	14902.5 4.6	15449.6 6.6	16054.5 7.0	16700.5 6.1	17374.2 4.1	18062.5 1.4	18751.2 -1.5	19425.5 -4.5	20070.9 -7.5	20673.8 -10.8	-45
-50	10566.6 -12.0	10647.7 -7.9	10993.4 -3.8	11543.0 -0.5	12236.2 1.7	13021.7 2.7	13858.8 2.6	14715.8 1.8	15567.9 0.6	16395.1 -1.0	17182.0 -2.9	17916.9 -5.3	-50
-55	7488.5 -17.5	7048.2 -16.5	7068.8 -13.6	7504.7 -9.5	8243.1 -5.5	9164.5 -2.2	10176.5 0.1	11216.6 1.5	12244.3 2.2	13234.0 2.3	14169.7 1.7	15041.9 0.5	-55
-60	5684.0 -10.5	4376.8 -16.0	3531.0 -20.6	3458.0 -19.4	4133.1 -12.9	5208.5 -6.4	6426.1 -1.6	7665.2 1.8	8871.8 4.2	10020.5 5.6	11099.7 6.2	12105.0 6.2	-60
-65	6127.0 9.9	4497.1 8.2	2872.0 6.4	1275.9 6.1	365.7 15.4	1830.6 6.4	3277.3 7.6	4657.9 9.2	5966.0 10.7	7199.4 11.8	8358.6 12.6	9446.1 13.0	-65
-70	8104.4 23.8	6893.9 24.4	5760.4 25.2	4778.2 26.7	4060.5 28.4	3744.9 29.3	3898.8 28.4	4438.5 26.4	5211.9 24.7	6100.7 23.5	7036.1 22.7	7981.2 22.2	-70
-75	10435.4 29.3	9654.7 29.7	8937.7 30.1	8313.5 30.5	7812.5 30.8	7462.3 31.0	7282.6 31.0	7280.3 30.7	7446.8 30.3	7761.4 29.7	8196.5 29.1	8724.2 28.5	-75
-80	12649.2 29.6	12216.1 29.9	11819.9 30.1	11470.9 30.2	11178.5 30.3	10951.0 30.2	10794.9 30.1	10714.2 30.0	10710.2 29.7	10781.7 29.4	10925.1 29.0	11134.6 28.5	-80
-85	14637.3 26.2	14467.5 26.3	14313.5 26.4	14177.9 26.4	14062.9 26.4	13970.5 26.4	13902.4 26.3	13859.8 26.1	13843.3 25.9	13853.3 25.6	13889.5 25.3	13951.3 25.0	-85
-90	16415.2 19.4	16415.2 19.4	16415.2 19.4	16415.2 19.4	16415.2 19.4	16415.2 19.4	16415.2 19.4	16415.2 19.4	16415.2 19.4	16415.2 19.4	16415.2 19.4	16415.2 19.4	-90
Lat E. Long	120	125	130	135	140	145	150	155	160	165	170	175	Lat E. Long

HORIZONTAL COMPONENT (H) WMM-95

E. Long	180	185	190	195	200	205	210	215	220	225	230	235	E. Long
Lat 0	34427.9 -28.7	34072.0 -30.2	33707.7 -29.9	33345.6 -28.3	32995.6 -26.3	32664.5 -24.6	32355.7 -24.0	32070.9 -24.8	31811.8 -27.0	31581.7 -30.2	31385.5 -33.7	31226.3 -36.6	Lat 0
-5	35012.8 -23.8	34685.1 -27.7	34317.0 -30.1	33922.7 -30.9	33517.6 -30.6	33113.8 -29.7	32718.8 -28.8	32336.1 -28.4	31968.5 -28.9	31621.6 -30.3	31304.8 -32.2	31028.3 -34.2	-5
-10	34937.1 -19.2	34653.0 -25.1	34305.2 -29.8	33910.5 -32.9	33488.7 -34.3	33056.4 -34.2	32623.5 -33.0	32194.2 -31.4	31770.5 -30.0	31357.2 -29.5	30964.1 -29.9	30604.6 -30.9	-10
-15	34164.4 -16.8	33945.6 -23.9	33650.6 -30.1	33296.9 -34.8	32906.9 -37.4	32499.9 -37.9	32087.4 -36.5	31672.7 -33.8	31255.1 -30.9	30835.4 -28.7	30419.9 -27.6	30020.2 -27.8	-15
-20	32762.2 -16.9	32633.6 -24.3	32425.8 -31.1	32155.8 -36.6	31846.2 -40.0	31516.9 -40.8	31179.0 -39.3	30834.3 -36.0	30478.1 -32.0	30105.4 -28.6	29716.4 -26.5	29317.4 -26.1	-20
-25	30870.8 -18.8	30854.6 -25.8	30763.4 -32.5	30611.8 -38.0	30420.4 -41.6	30207.3 -42.7	29982.2 -41.3	29744.6 -37.9	29486.1 -33.6	29196.7 -29.6	28869.8 -27.0	28506.2 -26.3	-25
-30	28655.3 -20.8	28766.0 -27.0	28808.7 -33.1	28794.9 -38.3	28741.2 -41.9	28662.4 -43.3	28566.1 -42.4	28450.1 -39.5	28304.5 -35.5	28116.3 -31.7	27875.1 -29.0	27576.9 -28.1	-30
-35	26258.9 -21.3	26500.8 -26.6	26680.9 -32.0	26807.3 -36.8	26892.0 -40.4	26946.4 -42.2	26976.2 -42.0	26979.3 -40.0	26947.1 -36.9	26867.4 -33.7	26729.2 -31.3	26526.6 -30.4	-35
-40	23772.4 -19.1	24141.9 -23.7	24452.7 -28.5	24709.8 -33.0	24922.0 -36.6	25098.0 -38.9	25243.2 -39.5	25357.6 -38.5	25436.5 -36.5	25471.6 -34.1	25454.4 -32.1	25378.6 -31.3	-40
-45	21224.2 -14.4	21715.8 -18.4	22148.1 -22.7	22524.7 -26.8	22852.9 -30.4	23140.6 -32.9	23394.6 -34.2	23618.7 -34.1	23813.1 -32.9	23974.9 -31.3	24098.7 -29.9	24178.7 -29.2	-45
-50	18592.2 -8.1	19204.5 -11.4	19754.4 -15.0	20246.5 -18.6	20688.4 -21.8	21089.1 -24.3	21457.7 -25.7	21801.5 -26.1	22125.4 -25.6	22430.3 -24.6	22713.4 -23.8	22967.9 -23.5	-50
-55	15846.3 -1.3	16582.8 -3.6	17254.6 -6.2	17868.6 -8.9	18433.8 -11.4	18960.8 -13.4	19460.4 -14.6	19942.2 -15.1	20412.7 -15.0	20874.2 -14.6	21324.1 -14.4	21754.2 -14.8	-55
-60	13037.0 5.5	13899.3 4.4	14698.4 2.9	15443.2 1.3	16143.9 -0.1	16811.4 -1.3	17456.3 -2.1	18087.3 -2.5	18709.9 -2.7	19325.2 -3.0	19928.9 -3.6	20512.1 -4.8	-60
-65	10466.2 13.0	11425.1 12.7	12330.2 12.2	13189.9 11.6	14013.2 10.9	14808.5 10.3	15583.5 9.8	16343.4 9.3	17090.7 8.6	17823.9 7.7	18537.8 6.3	19223.7 4.3	-65
-70	8917.4 21.9	9835.8 21.5	10733.2 21.1	11609.4 20.6	12466.1 20.1	13305.1 19.5	14127.9 18.8	14934.7 17.8	15724.2 16.6	16492.7 15.1	17234.9 13.1	17943.4 10.6	-70
-75	9319.9 27.8	9963.5 27.2	10639.6 26.5	11336.5 25.8	12045.4 25.0	12759.3 24.0	13472.5 23.0	14179.6 21.7	14875.2 20.2	15553.9 18.4	16210.0 16.3	16837.3 14.0	-75
-80	11403.3 27.9	11723.5 27.3	12087.2 26.6	12486.4 25.8	12913.7 25.0	13361.8 24.0	13824.0 22.9	14294.0 21.7	14766.0 20.4	15234.5 18.9	15694.1 17.3	16140.1 15.6	-80
-85	14037.6 24.6	14146.8 24.1	14277.1 23.6	14426.5 23.1	14592.6 22.5	14773.0 21.8	14965.2 21.2	15166.6 20.5	15374.7 19.7	15586.8 18.9	15800.7 18.1	16013.8 17.3	-85
-90	16415.2 19.4	16415.2 19.4	16415.2 19.4	16415.2 19.4	16415.2 19.4	16415.2 19.4	16415.2 19.4	16415.2 19.4	16415.2 19.4	16415.2 19.4	16415.2 19.4	16415.2 19.4	-90
Lat													Lat
E. Long	180	185	190	195	200	205	210	215	220	225	230	235	E. Long

HORIZONTAL COMPONENT (H) WMM-95

E. Long / Lat	240	245	250	255	260	265	270	275	280	285	290	295	E. Long / Lat
0	31100.5 -38.4	30992.9 -39.0	30875.3 -38.9	30709.2 -39.0	30455.7 -40.2	30089.8 -43.0	29614.8 -47.0	29069.1 -51.0	28518.8 -53.4	28037.2 -52.8	27678.7 -49.2	27463.0 -43.8	0
-5	30797.8 -35.7	30607.5 -36.4	30436.4 -36.6	30248.9 -36.9	30002.1 -38.1	29659.5 -40.7	29207.5 -44.8	28666.3 -49.7	28089.6 -53.8	27546.6 -55.8	27094.9 -55.4	26759.6 -53.1	-5
-10	30289.9 -32.2	30022.0 -33.3	29788.4 -34.2	29560.4 -35.0	29297.2 -36.2	28957.4 -38.6	28514.0 -42.4	27970.4 -47.3	27364.5 -52.2	26757.3 -55.9	26207.8 -57.8	25747.7 -58.3	-10
-15	29649.1 -29.0	29313.9 -30.7	29011.1 -32.3	28722.2 -33.8	28414.4 -35.4	28048.1 -37.4	27590.3 -40.6	27030.3 -44.8	26390.6 -49.4	25721.4 -53.7	25080.1 -57.0	24505.2 -59.4	-15
-20	28919.6 -27.3	28533.6 -29.4	28163.9 -31.8	27803.6 -33.9	27432.0 -35.8	27017.2 -37.6	26526.3 -39.9	25940.3 -43.1	25268.6 -46.9	24549.3 -50.8	23835.3 -54.5	23169.3 -57.8	-20
-25	28113.5 -27.4	27703.4 -29.8	27286.8 -32.7	26867.0 -35.4	26435.6 -37.5	25970.9 -39.1	25444.9 -40.8	24836.2 -42.9	24144.3 -45.5	23396.3 -48.6	22637.2 -51.8	21910.3 -55.3	-25
-30	27226.1 -29.1	26833.2 -31.6	26411.8 -34.7	25971.5 -37.6	25512.7 -40.0	25023.0 -41.6	24481.3 -43.0	23867.6 -44.3	23176.7 -46.0	22425.9 -48.0	21651.2 -50.5	20891.8 -53.5	-30
-35	26260.5 -31.2	25938.5 -33.4	25571.9 -36.4	25170.9 -39.5	24739.0 -42.2	24269.6 -44.2	23747.8 -45.7	23157.9 -46.9	22493.8 -48.1	21766.2 -49.4	21001.9 -51.2	20233.4 -53.7	-35
-40	25242.1 -31.9	25046.9 -33.9	24798.2 -36.7	24500.9 -40.0	24156.2 -43.1	23759.1 -45.7	23299.5 -47.9	22766.5 -49.6	22156.2 -50.9	21475.9 -52.2	20745.1 -53.7	19988.7 -55.7	-40
-45	24208.9 -29.8	24184.8 -31.6	24102.9 -34.5	23959.8 -38.0	23751.3 -41.7	23471.3 -45.3	23112.3 -48.5	22668.2 -51.1	22138.0 -53.2	21528.6 -55.0	20854.4 -56.7	20134.5 -58.6	-45
-50	23184.4 -24.3	23351.7 -26.3	23458.5 -29.4	23493.7 -33.4	23447.7 -37.9	23312.4 -42.4	23081.8 -46.7	22752.9 -50.4	22327.5 -53.6	21812.9 -56.2	21221.1 -58.4	20567.5 -60.5	-50
-55	22152.2 -16.1	22502.9 -18.6	22790.1 -22.2	22998.6 -26.7	23115.8 -31.8	23132.3 -37.1	23042.7 -42.2	22846.0 -46.9	22545.3 -51.0	22148.3 -54.4	21665.9 -57.2	21111.9 -59.6	-55
-60	21061.4 -6.9	21561.2 -10.0	21994.9 -14.0	22347.2 -18.8	22605.5 -24.2	22760.8 -29.8	22808.5 -35.3	22748.0 -40.5	22583.0 -45.0	22320.7 -48.9	21971.4 -52.1	21547.4 -54.5	-60
-65	19870.0 1.5	20463.4 -2.0	20990.6 -6.2	21439.2 -11.0	21799.1 -16.1	22063.2 -21.5	22227.8 -26.7	22292.8 -31.6	22261.4 -36.1	22139.8 -39.9	21936.7 -42.9	21663.0 -45.1	-65
-70	18609.5 7.7	19224.1 4.2	19778.0 0.3	20263.0 -3.9	20672.4 -8.3	21001.5 -12.8	21248.0 -17.1	21412.0 -21.2	21495.8 -24.9	21504.3 -28.0	21444.0 -30.5	21323.2 -32.3	-70
-75	17429.6 11.4	17981.0 8.5	18485.7 5.5	18938.9 2.3	19336.6 -0.9	19676.2 -4.1	19956.2 -7.2	20176.8 -10.0	20339.4 -12.6	20446.8 -14.7	20503.2 -16.4	20513.7 -17.7	-75
-80	16568.0 13.8	16973.8 12.0	17353.8 10.1	17705.1 8.1	18025.2 6.2	18312.4 4.4	18565.6 2.7	18784.5 1.1	18969.4 -0.3	19121.4 -1.5	19241.9 -2.5	19333.2 -3.1	-80
-85	16224.2 16.5	16429.7 15.6	16628.6 14.8	16819.3 14.0	17000.3 13.2	17170.6 12.5	17329.1 11.8	17475.3 11.2	17608.5 10.7	17728.7 10.2	17835.6 9.8	17929.5 9.6	-85
-90	16415.2 19.4	16415.2 19.4	16415.2 19.4	16415.2 19.4	16415.2 19.4	16415.2 19.4	16415.2 19.4	16415.2 19.4	16415.2 19.4	16415.2 19.4	16415.2 19.4	16415.2 19.4	-90
Lat													Lat
E. Long	240	245	250	255	260	265	270	275	280	285	290	295	E. Long

HORIZONTAL COMPONENT (H) WMM-95

E. Long / Lat	300	305	310	315	320	325	330	335	340	345	350	355	E. Long / Lat
0	27374.9 -38.6	27375.4 -35.2	27413.5 -34.4	27436.1 -35.8	27400.0 -38.3	27286.6 -40.5	27114.0 -41.2	26934.2 -40.0	26814.3 -36.8	26813.3 -32.1	26963.0 -26.8	27262.1 -21.9	0
-5	26527.9 -50.8	26359.3 -49.7	26200.2 -50.6	25997.5 -53.0	25712.4 -55.9	25336.0 -58.0	24899.4 -58.5	24467.8 -56.7	24119.0 -53.1	23915.8 -48.1	23887.2 -42.7	24026.0 -38.0	-5
-10	25370.9 -58.5	25040.3 -59.7	24703.6 -62.3	24309.5 -65.8	23824.3 -69.4	23246.1 -72.0	22611.5 -72.7	21988.0 -71.4	21451.1 -68.4	21057.9 -64.3	20831.7 -59.9	20761.8 -55.9	-10
-15	24000.1 -61.8	23535.4 -64.8	23063.0 -69.0	22535.3 -73.7	21921.8 -78.3	21222.8 -81.7	20473.0 -83.5	19732.4 -83.5	19064.8 -82.0	18515.4 -79.5	18099.8 -76.6	17807.8 -73.5	-15
-20	22564.7 -61.4	22002.0 -65.9	21439.9 -71.3	20834.8 -77.3	20158.0 -83.0	19408.0 -87.8	18612.5 -91.0	17818.8 -92.7	17075.4 -93.0	16414.8 -92.3	15846.7 -90.6	15364.8 -88.1	-20
-25	21236.4 -59.4	20605.9 -64.5	19986.2 -70.8	19339.0 -77.8	18637.0 -84.7	17875.7 -90.8	17074.4 -95.5	16267.8 -98.8	15490.9 -100.6	14766.8 -101.1	14103.7 -100.0	13502.4 -97.2	-25
-30	20171.9 -57.6	19490.8 -62.9	18825.7 -69.5	18145.8 -77.0	17427.4 -84.6	16664.6 -91.6	15870.6 -97.4	15070.5 -101.6	14290.5 -104.1	13549.3 -104.8	12857.4 -103.3	12223.8 -99.4	-30
-35	19484.5 -57.3	18760.9 -62.3	18050.4 -68.7	17332.7 -76.1	16591.0 -83.7	15821.7 -90.7	15035.3 -96.5	14252.0 -100.7	13493.4 -102.8	12777.6 -102.7	12118.8 -99.9	11532.5 -94.4	-35
-40	19227.9 -58.8	18472.6 -63.2	17720.9 -68.8	16964.3 -75.3	16196.4 -81.9	15418.9 -87.9	14643.4 -92.7	13888.3 -95.6	13173.7 -96.4	12518.0 -94.6	11937.9 -90.3	11452.0 -83.2	-40
-45	19386.7 -61.3	18623.9 -64.8	17852.6 -69.1	17075.5 -74.0	16296.7 -78.7	15525.0 -82.8	14775.0 -85.5	14064.9 -86.3	13414.0 -85.1	12840.3 -81.6	12360.7 -75.8	11992.6 -67.8	-45
-50	19868.0 -62.8	19137.1 -65.4	18387.1 -68.2	17629.2 -71.0	16875.6 -73.4	16140.7 -74.9	15441.8 -75.1	14797.0 -73.7	14224.4 -70.5	13740.3 -65.6	13359.1 -58.9	13094.6 -50.9	-50
-55	20501.2 -61.6	19849.3 -63.2	19171.3 -64.6	18483.2 -65.4	17801.2 -65.6	17142.5 -64.7	16524.9 -62.7	15965.6 -59.4	15480.3 -54.9	15082.7 -49.1	14784.1 -42.5	14593.7 -35.3	-55
-60	21063.0 -56.2	20533.4 -57.2	19974.6 -57.4	19403.0 -56.9	18835.5 -55.4	18289.0 -53.0	17779.6 -49.6	17322.2 -45.3	16929.7 -40.2	16612.8 -34.6	16379.6 -28.6	16235.8 -22.5	-60
-65	21331.1 -46.5	20954.6 -47.0	20547.8 -46.6	20125.6 -45.4	19702.5 -43.3	19292.7 -40.3	18909.6 -36.6	18564.9 -32.3	18268.4 -27.6	18028.0 -22.7	17849.2 -17.8	17735.0 -13.1	-65
-70	21151.4 -33.3	20939.1 -33.6	20697.4 -33.0	20437.5 -31.8	20170.6 -29.8	19907.0 -27.2	19656.4 -24.1	19427.3 -20.6	19226.5 -16.9	19059.3 -13.2	18929.1 -9.5	18837.7 -6.0	-70
-75	20484.1 -18.3	20421.2 -18.5	20331.9 -18.1	20223.2 -17.2	20101.9 -15.9	19974.7 -14.1	19847.5 -12.1	19725.4 -9.8	19612.7 -7.3	19512.4 -4.8	19426.5 -2.3	19355.9 0.0	-75
-80	19397.8 -3.6	19438.5 -3.7	19458.5 -3.5	19460.9 -3.1	19448.7 -2.4	19425.1 -1.6	19392.6 -0.5	19353.7 0.7	19310.3 2.0	19263.8 3.4	19215.1 4.8	19164.7 6.2	-80
-85	18010.5 9.4	18079.0 9.3	18135.5 9.3	18180.5 9.4	18214.6 9.6	18238.4 9.9	18252.3 10.2	18256.9 10.6	18252.6 11.1	18239.6 11.6	18218.3 12.2	18188.7 12.8	-85
-90	16415.2 19.4	16415.2 19.4	16415.2 19.4	16415.2 19.4	16415.2 19.4	16415.2 19.4	16415.2 19.4	16415.2 19.4	16415.2 19.4	16415.2 19.4	16415.2 19.4	16415.2 19.4	-90
Lat													Lat
E. Long	300	305	310	315	320	325	330	335	340	345	350	355	E. Long

TOTAL INTENSITY (F) WMM-95

E. Long Lat	0	5	10	15	20	25	30	35	40	45	50	55	E. Long Lat
90	56281.0 -10.4	56281.0 -10.4	56281.0 -10.4	56281.0 -10.4	56281.0 -10.4	56281.0 -10.4	56281.0 -10.4	56281.0 -10.4	56281.0 -10.4	56281.0 -10.4	56281.0 -10.4	56281.0 -10.4	90
85	55367.1 -5.6	55389.3 -5.7	55423.0 -5.8	55467.9 -6.0	55523.5 -6.3	55589.3 -6.6	55664.4 -6.9	55747.8 -7.3	55838.5 -7.7	55935.1 -8.2	56036.3 -8.6	56140.6 -9.1	85
80	54370.3 0.1	54400.5 0.0	54460.9 -0.1	54550.9 -0.4	54669.8 -0.9	54816.3 -1.4	54988.5 -2.0	55184.2 -2.8	55400.5 -3.6	55634.2 -4.5	55881.4 -5.5	56138.0 -6.5	80
75	53368.8 5.3	53395.1 5.4	53471.6 5.4	53598.0 5.1	53773.3 4.6	53995.9 4.0	54263.6 3.2	54573.2 2.3	54920.8 1.3	55301.5 0.1	55709.4 -1.2	56137.3 -2.5	75
70	52380.1 9.3	52399.1 9.7	52485.5 9.8	52638.8 9.7	52857.9 9.3	53141.4 8.7	53487.2 7.9	53892.5 7.0	54353.4 6.0	54864.6 4.8	55419.1 3.5	56007.8 2.1	70
65	51374.6 12.0	51393.0 12.7	51490.7 13.0	51666.2 13.0	51917.9 12.7	52244.6 12.2	52645.1 11.5	53117.8 10.6	53660.2 9.7	54267.9 8.7	54934.3 7.6	55649.8 6.4	65
60	50299.0 13.4	50332.1 14.6	50450.2 15.3	50649.4 15.4	50927.2 15.2	51282.5 14.6	51715.4 13.8	52226.1 12.9	52814.2 11.9	53477.4 11.0	54210.7 10.1	55005.2 9.1	60
55	49096.4 14.1	49165.0 15.9	49318.0 17.0	49548.3 17.4	49851.5 17.1	50226.3 16.3	50674.3 15.2	51198.1 13.9	51800.1 12.7	52480.1 11.7	53234.9 10.8	54057.0 10.0	55
50	47717.1 14.2	47842.9 16.9	48047.7 18.6	48319.7 19.3	48651.6 19.0	49042.2 17.8	49495.0 16.1	50015.5 14.3	50608.3 12.5	51275.2 11.1	52013.7 10.0	52817.7 9.1	50
45	46123.1 13.9	46323.5 17.7	46594.0 20.3	46916.8 21.4	47281.7 20.9	47688.0 19.2	48141.8 16.8	48651.8 14.2	49224.3 11.8	49860.9 9.8	50558.6 8.4	51311.1 7.2	45
40	44295.3 13.3	44577.3 18.4	44918.5 21.8	45294.9 23.1	45694.0 22.4	46116.2 20.2	46571.6 17.0	47071.9 13.7	47623.8 10.8	48226.5 8.4	48873.7 6.6	49558.0 5.1	40
35	42246.5 12.4	42603.5 18.4	43008.3 22.4	43431.7 23.9	43859.6 22.9	44295.3 20.1	44753.1 16.4	45247.7 12.7	45784.9 9.5	46359.5 7.1	46959.9 5.3	47575.7 3.6	35
30	40038.5 11.2	40452.6 17.7	40903.2 21.8	41358.2 23.1	41803.3 21.8	42245.0 18.5	42701.9 14.5	43191.6 10.8	43718.7 7.8	44273.0 5.8	44836.9 4.3	45396.7 2.9	30
25	37795.0 9.7	38243.8 15.9	38718.0 19.6	39185.1 20.5	39631.9 18.8	40067.2 15.3	40513.1 11.3	40989.5 7.8	41501.6 5.4	42036.8 4.1	42574.3 3.4	43097.5 2.6	25
20	35693.6 8.3	36159.5 13.3	36638.9 16.1	37101.7 16.3	37535.3 14.3	37948.8 10.8	38365.6 7.0	38808.7 3.9	39287.8 2.1	39794.8 1.6	40310.8 1.9	40819.1 2.2	20
15	33925.9 7.2	34404.2 10.4	34882.1 11.8	35332.4 11.1	35742.2 8.8	36118.3 5.3	36483.2 1.7	36864.8 -1.1	37283.7 -2.5	37745.6 -2.2	38241.9 -0.7	38758.6 1.2	15
10	32624.9 6.7	33127.9 7.5	33612.3 7.1	34052.7 5.5	34434.3 2.6	34759.8 -1.0	35051.2 -4.7	35344.6 -7.4	35678.9 -8.5	36082.7 -7.4	36565.6 -4.4	37119.1 -0.4	10
5	31794.2 6.4	32345.9 4.7	32855.7 2.2	33296.3 -0.9	33649.9 -4.7	33916.9 -8.8	34122.2 -12.7	34315.2 -15.4	34559.1 -16.0	34911.2 -13.8	35402.8 -8.9	36031.5 -2.1	5
0	31292.7 5.5	31914.0 1.1	32465.5 -3.7	32914.4 -8.8	33240.8 -13.9	33447.7 -18.8	33569.5 -23.0	33674.6 -25.4	33853.0 -24.9	34190.1 -20.7	34736.4 -12.9	35491.9 -2.6	0
Lat E. Long	0	5	10	15	20	25	30	35	40	45	50	55	Lat E. Long

TOTAL INTENSITY (F) WMM-95

E. Long	60	65	70	75	80	85	90	95	100	105	110	115	E. Long
Lat													Lat
90	56281.0 -10.4	56281.0 -10.4	56281.0 -10.4	56281.0 -10.4	56281.0 -10.4	56281.0 -10.4	56281.0 -10.4	56281.0 -10.4	56281.0 -10.4	56281.0 -10.4	56281.0 -10.4	56281.0 -10.4	90
85	56246.5 -9.6	56352.3 -10.1	56456.5 -10.6	56557.7 -11.1	56654.3 -11.5	56745.1 -12.0	56828.8 -12.4	56904.4 -12.8	56971.2 -13.1	57028.6 -13.4	57076.2 -13.7	57113.9 -13.9	85
80	56399.4 -7.6	56660.7 -8.7	56917.0 -9.7	57163.3 -10.8	57394.6 -11.9	57606.4 -12.9	57794.6 -13.8	57955.7 -14.7	58087.0 -15.4	58186.7 -16.1	58254.1 -16.5	58289.3 -16.8	80
75	56577.2 -4.0	57020.2 -5.5	57456.5 -7.1	57875.8 -8.7	58268.0 -10.3	58622.9 -11.8	58931.4 -13.3	59185.4 -14.7	59378.5 -15.8	59506.6 -16.8	59567.6 -17.5	59562.3 -17.9	75
70	56619.8 0.6	57242.1 -1.0	57859.8 -2.8	58456.6 -4.7	59015.5 -6.6	59519.3 -8.5	59951.6 -10.4	60297.8 -12.2	60546.0 -13.7	60688.0 -14.9	60719.7 -15.8	60641.8 -16.2	70
65	56401.8 5.0	57174.2 3.6	57947.8 1.9	58700.5 0.1	59408.4 -1.8	60046.5 -3.8	60590.2 -5.8	61017.0 -7.6	61307.8 -9.3	61449.0 -10.5	61433.3 -11.4	61261.2 -11.7	65
60	55847.9 8.2	56721.5 7.1	57603.9 5.8	58469.0 4.3	59287.2 2.7	60026.5 1.1	60654.4 -0.6	61140.0 -2.1	61456.6 -3.4	61583.9 -4.4	61510.6 -4.8	61235.7 -4.7	60
55	54934.4 9.3	55850.2 8.5	56782.0 7.7	57702.4 6.7	58578.4 5.7	59373.6 4.7	60048.9 3.8	60566.0 3.1	60890.5 2.7	60994.8 2.6	60862.6 3.0	60490.4 3.9	55
50	53676.7 8.4	54576.4 7.8	55496.8 7.2	56412.1 6.7	57289.9 6.4	58091.6 6.3	58774.7 6.5	59295.2 7.1	59611.5 8.1	59689.0 9.4	59504.9 11.1	59052.5 13.1	50
45	52110.3 6.3	52945.8 5.5	53803.0 4.9	54660.6 4.6	55489.7 4.8	56253.1 5.7	56907.4 7.3	57405.4 9.6	57700.4 12.3	57751.1 15.4	57528.2 18.6	57019.5 21.8	45
40	50273.3 3.8	51014.5 2.6	51774.1 1.6	52537.6 1.2	53281.3 1.8	53972.0 3.6	54568.1 6.5	55022.3 10.5	55285.3 15.1	55311.1 20.0	55063.6 24.7	54525.2 29.0	40
35	48202.7 1.9	48841.4 0.1	49491.8 -1.4	50146.3 -2.1	50787.3 -1.5	51385.9 0.9	51904.9 4.9	52299.9 10.4	52522.5 16.6	52524.5 23.0	52265.6 28.9	51722.5 33.9	35
30	45949.1 1.0	46499.1 -1.1	47052.4 -3.1	47607.0 -4.3	48149.2 -3.8	48654.8 -1.3	49091.2 3.4	49419.9 9.7	49597.0 16.9	49576.2 24.1	49315.8 30.5	48789.0 35.7	30
25	43602.6 1.1	44096.2 -0.9	44586.0 -3.1	45071.7 -4.6	45540.9 -4.4	45971.8 -2.1	46336.6 2.4	46603.4 8.7	46735.8 15.8	46693.5 23.0	46438.4 29.2	45943.9 34.0	25
20	41313.4 1.8	41796.8 0.5	42273.3 -1.2	42738.9 -2.6	43179.3 -2.8	43572.4 -1.3	43893.2 2.1	44115.8 7.2	44212.0 13.2	44151.6 19.4	43905.0 24.8	43451.7 28.9	20
15	39284.6 2.5	39813.0 3.0	40337.0 2.6	40843.8 1.7	41312.9 1.0	41719.3 1.1	42037.6 2.4	42244.8 5.1	42320.7 8.9	42247.2 13.2	42009.3 17.5	41598.2 20.9	15
10	37724.1 3.5	38357.5 6.5	38994.6 8.1	39608.6 8.1	40170.2 6.8	40648.2 4.9	41013.0 3.2	41240.8 2.5	41317.2 3.2	41237.9 5.2	41006.7 8.0	40632.3 11.0	10
5	36767.1 5.2	37565.0 11.4	38378.3 15.3	39163.4 16.2	39879.4 14.1	40486.6 9.9	40947.8 4.7	41235.1 0.1	41337.6 -2.8	41264.8 -3.3	41041.1 -1.9	40696.1 0.7	5
0	36411.9 8.3	37428.8 17.7	38472.8 23.8	39483.2 25.4	40407.1 22.3	41194.5 15.6	41799.0 7.1	42186.3 -1.2	42346.9 -7.3	42302.1 -10.3	42096.0 -10.3	41778.8 -8.3	0
Lat													Lat
E. Long	60	65	70	75	80	85	90	95	100	105	110	115	E. Long

TOTAL INTENSITY (F) WMM-95

E. Long	120	125	130	135	140	145	150	155	160	165	170	175	E. Long
Lat													Lat
90	56281.0 -10.4	56281.0 -10.4	56281.0 -10.4	56281.0 -10.4	56281.0 -10.4	56281.0 -10.4	56281.0 -10.4	56281.0 -10.4	56281.0 -10.4	56281.0 -10.4	56281.0 -10.4	56281.0 -10.4	90
85	57141.9 -14.0	57160.4 -14.1	57170.2 -14.1	57171.9 -14.1	57166.3 -14.1	57154.4 -14.0	57137.3 -13.9	57116.0 -13.7	57091.5 -13.6	57064.7 -13.4	57036.5 -13.2	57007.7 -13.0	85
80	58293.7 -17.0	58269.6 -17.0	58220.0 -16.8	58148.9 -16.5	58060.8 -16.1	57960.5 -15.6	57853.0 -15.0	57743.2 -14.3	57635.6 -13.7	57534.5 -13.0	57443.2 -12.5	57364.5 -12.0	80
75	59493.8 -18.0	59368.0 -17.7	59192.6 -17.2	58977.5 -16.4	58734.0 -15.3	58473.8 -14.0	58209.2 -12.6	57952.0 -11.2	57712.9 -9.8	57501.4 -8.5	57325.0 -7.4	57189.4 -6.6	75
70	60460.1 -16.2	60184.9 -15.6	59830.9 -14.5	59416.2 -13.0	58961.5 -11.1	58488.4 -8.9	58019.1 -6.5	57574.5 -4.1	57173.6 -1.8	56832.4 0.2	56563.3 1.8	56375.0 2.8	70
65	60940.8 -11.3	60488.0 -10.3	59925.5 -8.7	59281.3 -6.5	58587.0 -3.7	57876.1 -0.6	57181.6 2.8	56534.7 6.1	55962.8 9.2	55488.8 11.8	55129.9 13.7	54897.4 14.6	65
60	60769.8 -3.9	60134.2 -2.4	59360.0 -0.2	58485.6 2.7	57554.3 6.1	56610.9 9.9	55699.3 13.9	54859.7 17.7	54127.3 21.2	53530.6 24.0	53090.6 25.9	52820.4 26.5	60
55	59890.1 5.4	59087.9 7.5	58123.0 10.1	57043.7 13.4	55904.0 17.0	54759.1 20.9	53661.5 24.9	52658.9 28.6	51791.6 31.9	51091.9 34.4	50583.2 35.7	50279.6 35.7	55
50	58343.0 15.4	57406.5 18.0	56289.0 21.0	55047.9 24.1	53746.1 27.5	52447.1 30.8	51209.8 34.0	50086.4 36.8	49120.1 39.1	48345.0 40.5	47785.3 40.8	47454.9 39.9	50
45	56234.6 24.9	55205.5 27.9	53983.5 30.8	52633.2 33.5	51224.8 36.0	49827.3 38.1	48503.8 39.8	47308.3 40.8	46285.3 41.3	45469.3 41.0	44883.8 39.9	44541.4 37.9	45
40	53701.9 32.7	52625.8 35.8	51351.6 38.3	49949.0 40.1	48493.1 41.3	47056.0 41.7	45702.1 41.3	44485.9 40.2	43451.9 38.3	42634.2 35.9	42055.4 33.1	41724.9 30.0	40
35	50897.0 37.8	49819.8 40.5	48546.8 42.3	47150.1 43.0	45706.5 42.7	44288.6 41.3	42959.9 38.8	41773.6 35.4	40773.8 31.1	39994.1 26.6	39455.7 22.0	39163.7 17.8	35
30	47994.2 39.3	46959.2 41.4	45738.8 42.2	44404.0 41.8	43030.1 40.1	41686.8 37.2	40434.1 33.0	39322.8 27.6	38395.9 21.4	37686.6 15.0	37214.0 9.0	36978.4 4.0	30
25	45206.4 37.0	44250.9 38.4	43127.9 38.3	41903.7 37.0	40647.9 34.3	39424.0 30.3	38286.7 25.0	37282.9 18.4	36453.3 11.1	35830.2 3.6	35430.5 -3.3	35250.0 -8.8	25
20	42789.4 31.3	41939.7 32.2	40946.5 31.5	39866.8 29.6	38760.6 26.4	37682.6 21.9	36680.4 16.1	35796.0 9.2	35066.9 1.6	34523.0 -6.1	34179.1 -13.0	34027.9 -18.6	20
15	41017.1 23.0	40284.9 23.7	39435.9 23.0	38513.9 21.0	37565.8 17.7	36636.0 13.1	35764.4 7.4	34987.5 0.8	34338.6 -6.3	33844.0 -13.4	33516.6 -19.7	33348.6 -24.7	15
10	40127.1 13.3	39508.2 14.4	38798.1 14.1	38025.1 12.4	37221.0 9.2	36419.2 4.8	35652.6 -0.6	34952.2 -6.5	34345.9 -12.6	33855.9 -18.5	33493.4 -23.7	33253.3 -27.8	10
5	40254.5 3.4	39732.4 5.2	39141.1 5.5	38492.3 4.2	37803.0 1.3	37096.5 -2.8	36399.1 -7.6	35736.3 -12.7	35130.4 -17.5	34599.1 -22.0	34152.5 -25.9	33790.4 -28.8	5
0	41388.5 -5.5	40943.0 -3.3	40444.1 -2.6	39889.4 -3.5	39282.9 -6.1	38638.6 -9.7	37976.9 -13.7	37318.1 -17.6	36679.0 -21.2	36072.6 -24.2	35508.6 -26.8	34992.9 -28.7	0
Lat													Lat
E. Long	120	125	130	135	140	145	150	155	160	165	170	175	E. Long

TOTAL INTENSITY (F) WMM-95

E. Long	180	185	190	195	200	205	210	215	220	225	230	235	E. Long
Lat 90	56281.0 -10.4	56281.0 -10.4	56281.0 -10.4	56281.0 -10.4	56281.0 -10.4	56281.0 -10.4	56281.0 -10.4	56281.0 -10.4	56281.0 -10.4	56281.0 -10.4	56281.0 -10.4	56281.0 -10.4	Lat 90
85	56978.7 -12.8	56950.1 -12.6	56922.0 -12.5	56894.5 -12.3	56867.5 -12.2	56840.7 -12.0	56813.8 -11.9	56786.3 -11.8	56757.7 -11.7	56727.3 -11.6	56694.6 -11.4	56659.0 -11.3	85
80	57300.3 -11.6	57251.5 -11.3	57218.1 -11.1	57199.5 -11.1	57194.0 -11.1	57199.5 -11.3	57213.3 -11.5	57232.0 -11.8	57252.4 -12.2	57271.0 -12.5	57284.1 -12.8	57288.5 -13.1	80
75	57097.7 -6.1	57051.1 -5.9	57048.3 -6.1	57086.4 -6.7	57160.3 -7.5	57263.8 -8.6	57389.6 -9.9	57529.6 -11.4	57675.3 -12.9	57818.2 -14.3	57950.2 -15.7	58063.3 -17.0	75
70	56271.7 3.2	56253.9 2.8	56317.8 1.7	56456.4 0.0	56659.9 -2.3	56916.1 -5.1	57211.3 -8.2	57530.9 -11.5	57860.2 -14.7	58184.5 -17.8	58490.0 -20.7	58763.6 -23.3	70
65	54796.1 14.5	54825.0 13.3	54977.2 10.9	55241.1 7.5	55601.0 3.2	56038.2 -1.8	56532.1 -7.3	57061.0 -12.8	57603.6 -18.2	58139.1 -23.2	58647.9 -27.7	59111.9 -31.6	65
60	52725.2 25.7	52802.4 23.3	53042.3 19.4	53429.1 14.1	53941.8 7.6	54555.8 0.2	55244.3 -7.7	55979.3 -15.6	56733.5 -23.1	57480.6 -30.0	58196.2 -35.9	58857.8 -40.7	60
55	50186.1 34.0	50298.9 30.6	50606.3 25.3	51089.6 18.4	51724.3 9.9	52481.9 0.4	53331.2 -9.7	54239.8 -19.7	55175.7 -29.0	56108.6 -37.2	57010.4 -44.1	57855.4 -49.4	55
50	47358.0 37.4	47489.3 33.2	47835.3 27.1	48376.0 19.1	49085.7 9.5	49934.8 -1.4	50890.5 -12.9	51918.8 -24.3	52985.6 -34.9	54058.1 -44.0	55105.9 -51.2	56101.4 -56.4	50
45	44443.8 34.8	44582.5 30.3	44941.8 24.1	45500.5 16.1	46234.1 6.3	47115.1 -5.0	48113.3 -17.0	49196.4 -29.0	50330.9 -40.0	51483.7 -49.3	52624.0 -56.3	53722.9 -60.9	45
40	41639.4 26.4	41784.9 22.1	42141.2 16.6	42686.0 9.5	43397.1 0.7	44252.9 -9.8	45229.7 -21.3	46300.8 -33.0	47436.5 -43.8	48605.4 -52.6	49777.3 -59.0	50923.7 -62.7	40
35	39107.5 14.0	39264.7 10.2	39608.5 5.9	40114.8 0.5	40765.4 -6.6	41546.9 -15.4	42446.0 -25.5	43444.7 -36.1	44519.3 -45.9	45642.1 -54.0	46784.2 -59.4	47918.3 -62.0	35
30	36961.0 0.0	37129.7 -3.1	37450.4 -5.9	37897.3 -9.4	38457.1 -14.3	39126.4 -20.9	39903.5 -29.1	40780.9 -38.1	41742.0 -46.6	42763.2 -53.4	43818.3 -57.8	44882.0 -59.4	30
25	35262.5 -12.7	35427.9 -15.2	35706.8 -16.8	36072.7 -18.6	36517.9 -21.5	37048.3 -25.9	37673.1 -32.0	38394.1 -39.0	39201.4 -45.9	40075.7 -51.5	40993.9 -54.8	41934.2 -55.5	25
20	34039.4 -22.3	34169.9 -24.3	34378.3 -25.2	34640.0 -25.8	34951.8 -27.1	35326.9 -29.7	35781.6 -33.9	36324.0 -39.0	36949.2 -44.2	37642.0 -48.5	38383.5 -50.9	39156.5 -51.0	20
15	33311.1 -28.1	33363.1 -29.7	33466.4 -30.1	33599.9 -30.1	33764.0 -30.4	33974.5 -31.8	34250.2 -34.4	34601.5 -37.9	35026.6 -41.7	35514.2 -44.8	36050.7 -46.4	36624.7 -46.3	15
10	33113.1 -30.5	33040.1 -31.8	33003.7 -32.0	32987.3 -31.6	32992.3 -31.4	33032.7 -31.9	33124.9 -33.4	33278.5 -35.7	33493.1 -38.4	33761.8 -40.7	34077.0 -42.0	34433.7 -42.0	10
5	33501.0 -30.7	33264.0 -31.6	33059.4 -31.5	32875.4 -30.8	32711.9 -30.2	32577.7 -30.0	32483.1 -30.7	32435.0 -32.3	32434.2 -34.4	32478.6 -36.5	32566.9 -37.9	32700.1 -38.4	5
0	34525.5 -29.8	34100.9 -30.2	33710.5 -29.7	33347.2 -28.6	33008.3 -27.5	32695.4 -26.7	32411.6 -26.9	32160.4 -28.1	31944.0 -30.1	31765.4 -32.5	31629.2 -34.6	31541.3 -35.9	0
Lat													Lat
E. Long	180	185	190	195	200	205	210	215	220	225	230	235	E. Long

TOTAL INTENSITY (F) WMM-95

E. Long / Lat	240	245	250	255	260	265	270	275	280	285	290	295	E. Long / Lat
90	56281.0 -10.4	56281.0 -10.4	56281.0 -10.4	56281.0 -10.4	56281.0 -10.4	56281.0 -10.4	56281.0 -10.4	56281.0 -10.4	56281.0 -10.4	56281.0 -10.4	56281.0 -10.4	56281.0 -10.4	90
85	56619.9 -11.2	56576.9 -11.0	56529.6 -10.8	56477.9 -10.6	56421.7 -10.4	56361.0 -10.1	56296.2 -9.9	56227.5 -9.6	56155.6 -9.3	56081.2 -8.9	56005.1 -8.6	55928.2 -8.3	85
80	57281.1 -13.3	57259.2 -13.5	57220.6 -13.5	57163.6 -13.5	57087.1 -13.3	56990.8 -13.0	56874.8 -12.6	56740.1 -12.0	56588.2 -11.4	56421.2 -10.7	56241.8 -9.9	56053.0 -9.0	80
75	58150.7 -18.0	58206.1 -18.9	58224.3 -19.5	58201.4 -19.8	58134.8 -19.9	58023.1 -19.8	57866.7 -19.3	57667.1 -18.6	57427.5 -17.6	57152.4 -16.4	56847.3 -15.0	56518.8 -13.4	75
70	58993.8 -25.4	59170.1 -27.2	59283.8 -28.5	59328.0 -29.4	59297.7 -29.9	59190.4 -29.9	59005.8 -29.6	58746.3 -28.8	58417.1 -27.6	58025.5 -26.0	57581.5 -24.0	57096.7 -21.5	70
65	59514.8 -34.7	59842.0 -37.3	60080.7 -39.2	60220.1 -40.6	60252.0 -41.5	60171.4 -41.9	59976.6 -41.9	59670.2 -41.3	59259.0 -40.1	58754.2 -38.3	58170.8 -35.7	57526.9 -32.5	65
60	59444.9 -44.6	59938.8 -47.6	60322.2 -49.8	60579.9 -51.5	60699.0 -52.8	60670.3 -53.7	60489.5 -54.2	60157.9 -54.2	59683.6 -53.4	59081.1 -51.6	58371.4 -48.8	57580.1 -44.9	60
55	58619.7 -53.4	59280.8 -56.3	59817.2 -58.5	60208.0 -60.2	60434.8 -61.9	60482.6 -63.4	60342.4 -64.8	60012.9 -65.6	59502.1 -65.7	58827.5 -64.5	58015.7 -61.8	57100.5 -57.4	55
50	57018.5 -60.0	57831.5 -62.3	58514.5 -63.9	59041.3 -65.4	59386.3 -67.3	59527.9 -69.6	59450.9 -72.1	59149.9 -74.3	58631.4 -75.7	57914.6 -75.5	57030.9 -73.3	56021.9 -68.9	50
45	54753.2 -63.5	55687.1 -64.8	56494.9 -65.6	57144.6 -66.6	57603.9 -68.6	57843.4 -71.6	57841.3 -75.5	57587.3 -79.5	57085.3 -82.6	56354.5 -83.9	55429.7 -82.7	54358.5 -78.5	45
40	52016.8 -64.1	53027.7 -64.1	53923.5 -63.8	54667.4 -64.2	55220.3 -66.1	55545.9 -69.9	55616.1 -75.1	55415.4 -81.0	54944.7 -86.2	54222.3 -89.4	53284.0 -89.6	52181.5 -86.1	40
35	49017.5 -62.2	50052.6 -60.9	50988.9 -59.4	51785.4 -59.1	52397.9 -60.9	52784.1 -65.2	52910.6 -71.7	52757.8 -79.4	52323.8 -86.7	51625.3 -92.0	50697.6 -94.0	49593.3 -91.8	35
30	45929.2 -58.5	46932.2 -56.1	47856.0 -53.7	48657.4 -52.7	49288.3 -54.2	49702.1 -58.8	49861.6 -66.2	49744.6 -75.4	49346.9 -84.6	48683.4 -92.1	47787.6 -96.1	46710.8 -95.7	30
25	42875.1 -53.8	43792.0 -50.8	44651.6 -47.8	45410.5 -46.3	46018.9 -47.5	46427.6 -52.0	46597.0 -59.9	46502.9 -70.0	46139.8 -80.7	45520.7 -90.1	44676.4 -96.3	43655.3 -97.9	25
20	39945.0 -49.0	40729.1 -45.8	41479.4 -42.5	42154.5 -40.7	42704.9 -41.6	43080.6 -45.8	43240.7 -53.6	43159.6 -64.1	42830.2 -75.7	42263.3 -86.6	41487.0 -94.7	40545.3 -98.4	20
15	37226.6 -44.4	37842.5 -41.5	38448.0 -38.4	39005.7 -36.6	39468.6 -37.2	39787.9 -40.9	39922.4 -48.2	39845.1 -58.3	39546.6 -70.2	39035.4 -81.9	38336.4 -91.4	37489.3 -96.9	15
10	34828.4 -40.6	35252.9 -38.2	35688.1 -35.7	36101.7 -34.1	36451.0 -34.5	36690.5 -37.7	36779.9 -44.0	36691.5 -53.3	36413.7 -64.6	35952.1 -76.4	35328.8 -86.5	34580.0 -93.0	10
5	32879.3 -37.8	33100.5 -36.3	33348.6 -34.4	33596.2 -33.2	33806.0 -33.5	33937.2 -36.1	33952.9 -41.4	33826.5 -49.5	33545.6 -59.6	33114.1 -70.5	32552.2 -80.3	31893.7 -86.8	5
0	31505.8 -36.2	31520.1 -35.6	31571.3 -34.5	31634.9 -33.6	31678.7 -33.9	31667.7 -35.9	31570.8 -40.3	31365.8 -47.0	31043.3 -55.6	30608.6 -64.9	30081.9 -73.4	29496.6 -78.9	0
Lat													Lat
E. Long	240	245	250	255	260	265	270	275	280	285	290	295	E. Long

TOTAL INTENSITY (F) WMM-95

E. Long / Lat	300	305	310	315	320	325	330	335	340	345	350	355	E. Long / Lat
90	56281.0 -10.4	56281.0 -10.4	56281.0 -10.4	56281.0 -10.4	56281.0 -10.4	56281.0 -10.4	56281.0 -10.4	56281.0 -10.4	56281.0 -10.4	56281.0 -10.4	56281.0 -10.4	56281.0 -10.4	90
85	55851.8 -7.9	55776.8 -7.6	55704.5 -7.2	55636.0 -6.9	55572.6 -6.6	55515.3 -6.3	55465.4 -6.1	55423.8 -5.9	55391.4 -5.7	55369.0 -5.6	55357.2 -5.6	55356.4 -5.6	85
80	55858.4 -8.0	55661.7 -7.0	55466.6 -6.1	55277.1 -5.1	55097.0 -4.1	54929.9 -3.3	54779.4 -2.4	54648.4 -1.7	54539.8 -1.1	54455.9 -0.6	54398.8 -0.3	54369.9 0.0	80
75	56174.4 -11.6	55821.8 -9.8	55468.9 -7.8	55123.6 -5.9	54793.3 -3.9	54485.1 -2.1	54205.1 -0.4	53958.9 1.1	53751.0 2.4	53585.5 3.5	53465.2 4.3	53392.5 4.9	75
70	56583.9 -18.8	56056.5 -15.8	55528.2 -12.6	55011.8 -9.4	54519.2 -6.2	54060.9 -3.2	53645.9 -0.4	53281.6 2.1	52974.0 4.3	52727.4 6.1	52545.0 7.5	52428.9 8.6	70
65	56842.5 -28.7	56138.5 -24.4	55435.4 -19.8	54752.0 -15.0	54105.1 -10.4	53508.5 -6.0	52973.4 -2.0	52508.2 1.5	52118.9 4.6	51809.5 7.1	51582.0 9.2	51437.2 10.8	65
60	56736.2 -40.0	55869.2 -34.4	55008.0 -28.2	54178.2 -21.9	53401.4 -15.7	52694.1 -9.9	52068.7 -4.8	51533.3 -0.2	51092.8 3.6	50749.7 6.9	50504.3 9.6	50355.1 11.8	60
55	56120.6 -51.6	55115.8 -44.5	54124.2 -36.8	53178.8 -28.9	52306.0 -21.2	51524.4 -14.3	50845.9 -8.2	50277.3 -2.9	49821.2 1.6	49478.0 5.4	49245.9 8.8	49120.8 11.7	55
50	54935.9 -62.3	53823.7 -54.0	52733.5 -44.8	51706.6 -35.4	50773.8 -26.5	49955.4 -18.6	49261.6 -11.9	48696.0 -6.3	48258.5 -1.5	47947.0 2.9	47757.8 7.0	47684.4 10.8	50
45	53198.2 -71.5	52009.9 -62.3	50852.4 -51.8	49775.7 -41.2	48815.7 -31.4	47993.3 -23.0	47316.4 -16.1	46784.3 -10.4	46392.9 -5.4	46137.9 -0.6	46014.2 4.3	46013.8 9.2	45
40	50978.4 -79.1	49744.9 -69.4	48549.7 -58.1	47451.2 -46.7	46491.0 -36.3	45690.4 -27.6	45054.2 -20.7	44576.5 -15.1	44249.1 -10.0	44064.9 -4.7	44018.5 1.1	44100.8 7.3	40
35	48379.6 -85.4	47132.8 -75.8	45929.2 -64.2	44834.9 -52.3	43896.4 -41.5	43136.0 -32.6	42555.4 -25.6	42143.8 -20.0	41887.9 -14.7	41778.6 -8.9	41809.7 -2.2	41971.9 5.2	35
30	45520.2 -90.6	44294.0 -81.6	43112.8 -70.1	42047.9 -58.0	41150.0 -46.8	40443.3 -37.5	39927.2 -30.2	39586.8 -24.2	39404.5 -18.5	39367.8 -12.1	39469.5 -4.8	39699.8 3.3	30
25	42521.2 -94.5	41350.3 -86.7	40223.3 -75.7	39213.6 -63.5	38375.4 -51.8	37735.2 -41.6	37292.7 -33.5	37029.8 -26.6	36924.4 -20.3	36959.9 -13.5	37125.9 -6.0	37411.2 2.1	25
20	39496.9 -97.0	38413.0 -90.5	37370.7 -80.2	36443.3 -67.7	35687.6 -55.1	35133.2 -43.7	34781.1 -34.1	34611.0 -26.1	34595.5 -19.1	34711.7 -12.3	34943.8 -5.2	35278.0 1.8	20
15	36547.3 -97.1	35575.1 -91.9	34645.1 -82.1	33828.9 -69.3	33185.1 -55.4	32746.3 -42.3	32514.0 -31.0	32464.3 -21.9	32562.9 -14.4	32778.8 -8.1	33089.7 -2.4	33478.7 2.8	15
10	33754.0 -94.4	32910.2 -90.0	32116.1 -80.3	31441.0 -66.8	30943.7 -51.7	30657.3 -37.0	30580.7 -24.3	30683.7 -14.3	30923.6 -6.9	31261.6 -1.6	31670.5 2.1	32131.2 4.9	10
5	31184.0 -88.4	30478.0 -84.2	29838.6 -74.3	29331.2 -60.3	29011.1 -44.1	28907.2 -28.4	29011.5 -15.0	29285.8 -4.9	29680.5 1.8	30153.4 5.6	30676.1 7.3	31229.5 7.4	5
0	28896.1 -79.9	28330.9 -75.2	27857.6 -64.9	27533.5 -50.6	27404.6 -34.3	27489.4 -18.7	27771.0 -5.7	28205.2 3.7	28741.8 9.4	29341.3 11.7	29979.4 11.4	30637.4 9.1	0
Lat													Lat
E. Long	300	305	310	315	320	325	330	335	340	345	350	355	E. Long

TOTAL INTENSITY (F) WMM-95

Lat \ E. Long	0	5	10	15	20	25	30	35	40	45	50	55	Lat
0	31292.7 5.5	31914.0 1.1	32465.5 -3.7	32914.4 -8.8	33240.8 -13.9	33447.7 -18.8	33569.5 -23.0	33674.6 -25.4	33853.0 -24.9	34190.1 -20.7	34736.4 -12.9	35491.9 -2.6	0
-5	30898.4 2.6	31587.9 -4.4	32178.4 -11.7	32630.7 -19.0	32926.1 -25.8	33076.8 -31.5	33134.5 -35.5	33190.7 -36.7	33360.5 -34.0	33750.2 -26.7	34419.9 -15.3	35364.4 -1.2	-5
-10	30409.7 -4.0	31131.7 -13.2	31729.7 -22.8	32161.8 -32.0	32415.4 -40.0	32519.0 -45.9	32546.9 -48.9	32614.3 -47.7	32855.5 -41.6	33385.0 -30.4	34258.7 -15.0	35456.7 2.6	-10
-15	29719.4 -15.2	30408.0 -25.9	30958.8 -36.9	31333.7 -47.2	31532.9 -55.4	31605.3 -60.4	31649.5 -61.0	31800.6 -56.4	32201.3 -46.0	32959.4 -30.5	34111.8 -11.5	35615.9 8.4	-15
-20	28833.1 -31.1	29414.2 -42.3	29859.7 -53.5	30143.8 -63.3	30285.0 -70.1	30354.2 -72.6	30470.3 -69.6	30779.5 -60.6	31419.1 -45.8	32475.0 -26.6	33954.1 -5.4	35787.8 15.1	-20
-25	27843.7 -50.9	28264.9 -61.3	28571.1 -70.9	28755.8 -78.4	28858.4 -82.1	28969.0 -80.6	29218.3 -73.0	29750.0 -59.3	30680.9 -40.8	32063.9 -19.4	33872.5 2.1	36016.1 21.3	-25
-30	26892.3 -72.3	27148.0 -80.6	27325.8 -87.3	27442.3 -90.8	27555.8 -89.8	27768.0 -83.2	28208.0 -70.8	29001.5 -53.3	30233.2 -32.6	31920.0 -11.1	34008.5 8.7	36396.9 24.9	-30
-35	26145.5 -92.5	26280.2 -97.8	26387.5 -100.3	26503.5 -98.9	26698.5 -92.6	27073.2 -81.1	27740.3 -64.9	28795.5 -45.3	30288.1 -24.5	32206.2 -4.8	34483.1 11.8	37018.7 24.2	-35
-40	25793.1 -108.0	25881.8 -109.9	25998.9 -108.1	26192.0 -102.0	26531.7 -91.4	27104.6 -76.5	27996.4 -58.4	29269.2 -38.8	30943.3 -19.9	32991.4 -3.4	35347.2 9.6	37923.0 18.3	-40
-45	26045.7 -116.4	26157.5 -115.3	26349.1 -110.2	26668.6 -101.0	27175.9 -88.1	27935.9 -72.2	29005.1 -54.6	30417.8 -37.1	32176.4 -21.2	34250.0 -8.1	36582.0 1.3	39101.6 7.1	-45
-50	27094.6 -117.2	27263.5 -114.2	27549.4 -107.7	27992.7 -97.7	28637.8 -85.0	29527.4 -70.4	30694.5 -55.4	32155.0 -41.0	33902.9 -28.6	35910.8 -18.7	38134.6 -12.0	40520.6 -8.2	-50
-55	29040.6 -112.3	29260.5 -108.9	29616.1 -102.7	30137.3 -94.0	30853.6 -83.4	31790.7 -71.9	32965.9 -60.2	34384.9 -49.4	36039.3 -40.2	37907.2 -33.1	39956.1 -28.2	42146.7 -25.4	-55
-60	31847.0 -104.8	32089.8 -102.1	32470.3 -97.3	33008.6 -91.0	33722.9 -83.4	34627.6 -75.3	35731.1 -67.2	37033.8 -59.7	38527.8 -53.2	40196.5 -48.1	42016.6 -44.4	43959.3 -42.0	-60
-65	35359.2 -97.3	35596.7 -95.6	35961.6 -92.6	36466.0 -88.6	37120.5 -83.9	37932.5 -78.8	38905.3 -73.7	40037.3 -68.8	41321.5 -64.5	42745.9 -60.8	44293.6 -57.8	45944.2 -55.5	-65
-70	39367.7 -90.8	39581.1 -89.8	39903.4 -88.2	40341.0 -86.0	40899.1 -83.4	41580.7 -80.5	42386.2 -77.5	43313.1 -74.5	44355.8 -71.7	45505.3 -69.0	46750.0 -66.6	48075.3 -64.4	-70
-75	43660.4 -84.9	43838.4 -84.4	44101.5 -83.5	44452.4 -82.4	44892.4 -81.0	45422.0 -79.5	46039.9 -77.8	46743.4 -75.9	47527.8 -74.1	48386.8 -72.1	49312.5 -70.2	50295.4 -68.3	-75
-80	48039.2 -78.9	48171.9 -78.5	48362.6 -78.0	48611.5 -77.4	48918.2 -76.6	49281.8 -75.7	49700.4 -74.7	50171.5 -73.6	50691.8 -72.3	51257.2 -71.0	51862.7 -69.7	52502.8 -68.2	-80
-85	52306.7 -72.1	52381.5 -71.9	52485.0 -71.5	52616.9 -71.1	52776.4 -70.7	52962.5 -70.2	53173.8 -69.7	53409.0 -69.1	53666.1 -68.4	53943.3 -67.7	54238.1 -67.0	54548.2 -66.2	-85
-90	56246.8 -64.5	56246.8 -64.5	56246.8 -64.5	56246.8 -64.5	56246.8 -64.5	56246.8 -64.5	56246.8 -64.5	56246.8 -64.5	56246.8 -64.5	56246.8 -64.5	56246.8 -64.5	56246.8 -64.5	-90
Lat \ E. Long	0	5	10	15	20	25	30	35	40	45	50	55	Lat

TOTAL INTENSITY (F) WMM-95

E. Long	60	65	70	75	80	85	90	95	100	105	110	115	E. Long
Lat 0	36411.9	37428.8	38472.8	39483.2	40407.1	41194.5	41799.0	42186.3	42346.9	42302.1	42096.0	41778.8	Lat 0
	8.3	17.7	23.8	25.4	22.3	15.6	7.1	-1.2	-7.3	-10.3	-10.3	-8.3	
-5	36522.0	37803.3	39119.7	40396.0	41568.6	42577.6	43366.9	43895.5	44153.4	44169.6	44003.8	43723.3	-5
	13.2	25.2	32.8	34.5	30.4	21.7	10.5	-0.5	-9.2	-14.4	-15.9	-14.9	
-10	36898.5	38477.4	40092.0	41658.0	43104.3	44363.4	45371.1	46080.1	46477.7	46596.3	46504.0	46280.1	-10
	19.5	33.0	41.0	42.4	37.3	27.2	14.6	2.0	-8.3	-15.0	-18.2	-18.7	
-15	37372.6	39263.9	41182.9	43042.5	44768.4	46289.1	47535.6	48455.3	49031.7	49294.9	49314.3	49174.3	-15
	26.3	39.9	47.2	47.7	41.9	31.3	18.4	5.6	-5.1	-12.8	-17.3	-19.5	
-20	37861.9	40054.6	42260.1	44393.9	46383.4	48157.1	49644.6	50790.8	51573.8	52017.5	52185.3	52159.6	-20
	32.4	44.4	50.2	49.6	43.3	33.1	21.1	9.2	-1.0	-8.7	-14.1	-17.7	
-25	38373.4	40825.3	43273.1	45638.6	47854.0	49851.6	51563.4	52933.8	53936.1	54584.3	54930.6	55048.4	-25
	36.1	45.6	49.2	47.4	41.1	31.9	21.6	11.5	2.8	-4.2	-9.6	-14.1	
-30	38966.4	41607.1	44230.3	46766.0	49153.0	51329.5	53232.5	54808.0	56025.2	56887.2	57431.0	57715.5	-30
	36.4	42.7	44.1	41.2	35.2	27.5	19.3	11.6	5.0	-0.5	-5.2	-9.6	
-35	39705.5	42447.2	45166.2	47800.7	50296.0	52596.8	54646.4	56393.8	57805.2	58873.2	59618.3	60081.8	-35
	32.0	35.4	34.8	31.3	26.0	20.0	14.2	9.1	4.9	1.4	-1.9	-5.4	
-40	40627.8	43380.6	46114.8	48775.8	51314.3	53681.0	55825.0	57699.4	59268.8	60516.7	61448.5	62087.7	-40
	22.9	23.9	22.1	18.5	14.2	10.0	6.5	3.9	2.2	0.8	-0.6	-2.5	
-45	41736.3	44419.8	47095.5	49714.7	52232.7	54604.9	56785.7	58732.1	60408.5	61792.5	62877.5	63672.0	-45
	9.5	9.2	7.0	3.9	0.9	-1.6	-3.0	-3.4	-3.0	-2.3	-1.8	-1.9	
-50	43013.0	45558.7	48109.8	50623.1	53057.4	55372.1	57526.3	59480.9	61201.9	62663.9	63852.8	64766.5	-50
	-6.9	-7.5	-9.3	-11.3	-12.9	-13.7	-13.3	-12.0	-9.9	-7.6	-5.5	-4.0	
-55	44436.6	46784.0	49148.7	51492.4	53777.9	55968.4	58027.5	59920.5	61616.1	63089.4	64323.1	65308.9	-55
	-24.3	-24.5	-25.2	-25.9	-26.0	-25.3	-23.6	-21.1	-17.9	-14.5	-11.3	-8.6	
-60	45993.3	48085.5	50203.0	52312.7	54382.3	56379.3	58272.5	60032.1	61631.0	63046.6	64262.1	65266.8	-60
	-40.6	-39.8	-39.3	-38.7	-37.5	-35.7	-33.1	-29.8	-26.1	-22.2	-18.5	-15.2	
-65	47674.4	49459.0	51271.9	53086.3	54875.4	56612.7	58272.4	59830.4	61264.9	62557.0	63692.0	64659.6	-65
	-53.6	-52.1	-50.5	-48.8	-46.7	-44.1	-41.1	-37.7	-33.9	-30.1	-26.4	-23.1	
-70	49464.7	50900.2	52362.4	53831.3	55286.7	56708.6	58077.6	59375.7	60586.2	61694.9	62690.0	63562.9	-70
	-62.3	-60.2	-58.1	-55.8	-53.3	-50.5	-47.5	-44.3	-41.0	-37.7	-34.5	-31.5	
-75	51324.5	52387.9	53472.9	54566.2	55654.2	56723.7	57761.6	58755.7	59694.8	60569.0	61369.7	62090.3	-75
	-66.3	-64.2	-62.1	-59.9	-57.5	-55.1	-52.5	-49.9	-47.3	-44.8	-42.4	-40.1	
-80	53171.2	53861.2	54565.5	55276.7	55987.3	56689.8	57376.7	58041.2	58676.6	59277.0	59837.0	60352.0	-80
	-66.7	-65.1	-63.5	-61.8	-60.1	-58.4	-56.6	-54.9	-53.1	-51.5	-50.0	-48.5	
-85	54870.8	55203.2	55542.4	55885.4	56229.1	56570.5	56906.6	57234.4	57551.1	57854.1	58140.8	58409.1	-85
	-65.4	-64.6	-63.7	-62.9	-62.0	-61.2	-60.4	-59.6	-58.8	-58.0	-57.3	-56.7	
-90	56246.8	56246.8	56246.8	56246.8	56246.8	56246.8	56246.8	56246.8	56246.8	56246.8	56246.8	56246.8	-90
	-64.5	-64.5	-64.5	-64.5	-64.5	-64.5	-64.5	-64.5	-64.5	-64.5	-64.5	-64.5	
Lat													Lat
E. Long	60	65	70	75	80	85	90	95	100	105	110	115	E. Long

TOTAL INTENSITY (F) WMM-95

E. Long	120	125	130	135	140	145	150	155	160	165	170	175	E. Long
Lat 0	41388.5 -5.5	40943.0 -3.3	40444.1 -2.6	39889.4 -3.5	39282.9 -6.1	38638.6 -9.7	37976.9 -13.7	37318.1 -17.6	36679.0 -21.2	36072.6 -24.2	35508.6 -26.8	34992.9 -28.7	Lat 0
-5	43379.3 -12.7	42993.7 -10.8	42563.7 -10.1	42077.3 -10.9	41528.1 -13.0	40921.9 -15.8	40273.2 -18.7	39597.5 -21.3	38906.8 -23.4	38210.1 -25.1	37517.3 -26.6	36839.6 -27.7	-5
-10	45986.8 -17.8	45652.8 -16.9	45276.2 -16.9	44840.6 -17.8	44332.7 -19.5	43751.3 -21.2	43104.9 -22.7	42404.3 -23.6	41657.9 -24.2	40872.7 -24.7	40058.6 -25.4	39231.6 -26.3	-10
-15	48944.8 -20.4	48663.0 -21.1	48332.3 -22.2	47937.4 -23.5	47462.1 -24.8	46899.5 -25.5	46252.3 -25.5	45527.3 -24.9	44730.7 -24.1	43869.0 -23.7	42953.5 -23.9	42003.1 -24.8	-15
-20	52013.5 -20.4	51791.4 -22.9	51505.5 -25.2	51145.8 -27.1	50697.1 -28.3	50149.2 -28.3	49500.8 -27.2	48755.2 -25.4	47918.0 -23.7	46996.8 -22.8	46004.7 -23.0	44962.7 -24.2	-20
-25	55008.1 -18.1	54858.6 -21.9	54620.7 -25.3	54293.0 -27.9	53864.9 -29.3	53326.8 -29.1	52675.5 -27.7	51913.2 -25.7	51045.9 -23.8	50083.4 -23.0	49040.9 -23.5	47940.4 -25.2	-25
-30	57802.6 -14.0	57741.2 -18.4	57558.4 -22.5	57262.2 -25.7	56849.8 -27.6	56316.1 -27.9	55659.8 -27.1	54884.4 -25.6	53997.8 -24.5	53012.1 -24.3	51944.6 -25.6	50817.6 -28.0	-30
-35	60312.5 -9.3	60354.2 -13.4	60237.1 -17.6	59977.3 -21.1	59581.1 -23.6	59051.1 -24.9	58391.4 -25.3	57609.1 -25.2	56715.5 -25.4	55725.2 -26.5	54657.1 -28.7	53533.2 -31.9	-35
-40	62468.2 -5.2	62624.8 -8.4	62586.9 -12.0	62376.0 -15.5	62006.8 -18.4	61490.6 -20.8	60838.6 -22.5	60063.5 -24.1	59180.4 -26.0	58206.8 -28.5	57162.4 -31.8	56068.8 -35.7	-40
-45	64195.4 -2.9	64472.3 -4.8	64528.3 -7.4	64386.5 -10.3	64067.3 -13.4	63589.2 -16.4	62969.9 -19.3	62227.8 -22.4	61381.8 -25.7	60451.8 -29.5	59458.1 -33.8	58421.2 -38.2	-45
-50	65412.8 -3.4	65807.0 -3.8	65968.8 -5.1	65919.8 -7.2	65682.2 -9.9	65278.1 -13.0	64729.5 -16.5	64058.2 -20.3	63285.9 -24.5	62433.6 -29.1	61521.6 -34.0	60569.1 -38.8	-50
-55	66047.0 -6.7	66545.4 -5.8	66817.4 -5.9	66880.9 -6.9	66756.2 -8.9	66464.9 -11.5	66029.7 -14.9	65472.7 -18.8	64815.9 -23.2	64079.9 -27.9	63283.8 -32.8	62445.0 -37.7	-55
-60	66057.0 -12.5	66635.2 -10.7	67009.4 -9.8	67192.2 -9.9	67199.7 -11.0	67049.9 -12.8	66762.3 -15.5	66356.7 -18.8	65852.3 -22.7	65267.4 -26.9	64618.6 -31.4	63920.7 -36.0	-60
-65	65454.3 -20.2	66075.5 -18.0	66526.7 -16.5	66815.4 -15.9	66952.2 -16.1	66949.9 -17.1	66822.6 -18.9	66585.2 -21.3	66252.6 -24.2	65838.8 -27.6	65356.6 -31.3	64817.5 -35.3	-65
-70	64307.7 -28.9	64922.1 -26.8	65406.3 -25.2	65763.5 -24.3	65999.1 -23.9	66120.3 -24.2	66135.6 -25.1	66054.2 -26.6	65885.5 -28.5	65638.7 -30.9	65322.4 -33.7	64944.3 -36.7	-70
-75	62725.5 -38.1	63272.3 -36.4	63729.0 -35.0	64095.8 -34.1	64374.1 -33.6	64566.5 -33.4	64676.8 -33.8	64709.1 -34.5	64668.0 -35.6	64558.4 -37.1	64384.8 -38.9	64151.4 -40.9	-75
-80	60818.3 -47.3	61232.9 -46.2	61593.6 -45.3	61899.0 -44.6	62148.4 -44.1	62341.8 -43.9	62479.8 -44.0	62563.2 -44.3	62593.4 -44.8	62572.0 -45.5	62500.8 -46.5	62381.6 -47.6	-80
-85	58656.9 -56.2	58882.4 -55.7	59084.0 -55.3	59260.5 -55.0	59410.8 -54.8	59534.2 -54.6	59630.1 -54.6	59698.2 -54.7	59738.4 -54.8	59750.8 -55.1	59735.6 -55.5	59693.3 -55.9	-85
-90 Lat	56246.8 -64.5	56246.8 -64.5	56246.8 -64.5	56246.8 -64.5	56246.8 -64.5	56246.8 -64.5	56246.8 -64.5	56246.8 -64.5	56246.8 -64.5	56246.8 -64.5	56246.8 -64.5	56246.8 -64.5	-90 Lat
E. Long	120	125	130	135	140	145	150	155	160	165	170	175	E. Long

TOTAL INTENSITY (F) WMM-95

E. Long	180	185	190	195	200	205	210	215	220	225	230	235	E. Long
Lat 0	34525.5 -29.8	34100.9 -30.2	33710.5 -29.7	33347.2 -28.6	33008.3 -27.5	32695.4 -26.7	32411.6 -26.9	32160.4 -28.1	31944.0 -30.1	31765.4 -32.5	31629.2 -34.6	31541.3 -35.9	Lat 0
-5	36188.5 -28.4	35571.9 -28.4	34992.1 -27.6	34446.6 -26.1	33930.4 -24.4	33438.2 -23.1	32966.7 -22.8	32516.0 -23.9	32090.1 -26.2	31696.5 -29.2	31344.8 -32.2	31044.2 -34.6	-5
-10	38411.6 -26.9	37616.8 -27.0	36858.8 -26.1	36139.5 -24.4	35452.6 -22.2	34788.5 -20.4	34139.3 -19.7	33502.6 -20.6	32883.2 -23.2	32291.6 -26.9	31740.2 -30.8	31240.3 -34.2	-10
-15	41042.8 -25.8	40097.8 -26.3	39185.8 -25.8	38312.7 -24.1	37473.3 -21.8	36656.5 -19.6	35851.9 -18.5	35055.3 -19.2	34270.8 -21.8	33508.8 -25.9	32782.0 -30.5	32101.1 -34.8	-15
-20	43898.2 -25.8	42839.3 -27.0	41807.3 -27.1	40811.6 -25.8	39849.8 -23.5	38911.6 -21.2	37986.2 -19.7	37067.6 -20.1	36156.9 -22.4	35261.3 -26.5	34390.0 -31.4	33550.7 -36.3	-20
-25	46809.8 -27.5	45677.3 -29.5	44565.6 -30.2	43486.9 -29.4	42441.6 -27.5	41422.1 -25.1	40418.0 -23.5	39421.0 -23.4	38427.4 -25.3	37437.7 -29.0	36454.8 -33.9	35481.0 -39.1	-25
-30	49658.0 -30.9	48492.4 -33.5	47343.2 -34.8	46223.7 -34.6	45137.3 -33.1	44078.7 -31.0	43037.8 -29.3	42003.3 -28.9	40965.4 -30.4	39916.6 -33.8	38851.4 -38.5	37765.8 -43.8	-30
-35	52378.3 -35.4	51216.8 -38.4	50069.0 -40.2	48948.4 -40.6	47859.5 -39.6	46798.2 -38.0	45754.1 -36.6	44712.8 -36.3	43658.2 -37.6	42575.1 -40.7	41450.3 -45.2	40274.1 -50.6	-35
-40	54948.2 -39.7	53822.0 -43.0	52707.8 -45.3	51617.6 -46.3	50555.2 -46.1	49516.8 -45.3	48490.6 -44.6	47459.4 -44.7	46402.9 -46.3	45300.1 -49.4	44132.7 -53.8	42887.6 -59.1	-40
-45	57360.8 -42.6	56295.1 -46.3	55238.5 -49.1	54200.3 -50.8	53182.8 -51.6	52180.7 -51.8	51181.6 -52.2	50166.7 -53.2	49113.8 -55.4	48000.1 -58.7	46805.5 -63.2	45516.1 -68.4	-45
-50	59593.4 -43.4	58609.4 -47.5	57628.3 -50.9	56656.3 -53.4	55693.8 -55.3	54734.3 -56.9	53765.2 -58.5	52768.5 -60.7	51723.0 -63.6	50607.7 -67.3	49404.1 -71.9	48100.2 -76.9	-50
-55	61578.3 -42.4	60695.7 -46.8	59805.2 -50.7	58910.8 -54.0	58011.2 -57.0	57099.8 -59.8	56165.4 -62.7	55192.6 -65.8	54164.1 -69.5	53062.9 -73.6	51875.2 -78.2	50592.1 -82.8	-55
-60	63185.6 -40.6	62422.8 -45.0	61638.1 -49.2	60833.8 -53.1	60008.4 -56.9	59156.6 -60.6	58269.5 -64.3	57336.2 -68.2	56344.7 -72.2	55283.8 -76.5	54144 -80.8	52922.6 -85.0	-60
-65	64230.6 -39.4	63602.9 -43.5	62938.8 -47.5	62240.1 -51.6	61506.0 -55.6	60733.3 -59.6	59917.0 -63.7	59050.7 -67.7	58128.0 -71.8	57143.3 -75.8	56092.8 -79.7	54975.6 -83.4	-65
-70	64510.6 -40.0	64026.5 -43.4	63495.2 -47.0	62918.8 -50.6	62297.7 -54.3	61631.1 -58.0	60917.6 -61.7	60155.0 -65.4	59341.6 -68.9	58476.0 -72.4	57558.5 -75.7	56590.7 -78.7	-70
-75	63862.3 -43.2	63520.6 -45.7	63129.1 -48.4	62689.7 -51.1	62204.0 -54.0	61673.2 -56.8	61098.1 -59.7	60479.6 -62.6	59818.7 -65.4	59116.9 -68.0	58376.5 -70.5	57600.3 -72.8	-75
-80	62216.3 -49.0	62006.7 -50.4	61754.6 -52.0	61462.0 -53.7	61130.4 -55.5	60761.8 -57.3	60357.8 -59.1	59920.5 -60.9	59451.9 -62.7	58954.4 -64.4	58430.7 -66.1	57883.6 -67.7	-80
-85	59624.4 -56.4	59529.7 -57.0	59410.1 -57.6	59266.5 -58.3	59100.0 -59.1	58911.8 -59.8	58703.3 -60.6	58475.8 -61.5	58230.9 -62.3	57970.3 -63.1	57695.7 -63.9	57408.9 -64.7	-85
-90	56246.8 -64.5	56246.8 -64.5	56246.8 -64.5	56246.8 -64.5	56246.8 -64.5	56246.8 -64.5	56246.8 -64.5	56246.8 -64.5	56246.8 -64.5	56246.8 -64.5	56246.8 -64.5	56246.8 -64.5	-90
Lat													Lat
E. Long	180	185	190	195	200	205	210	215	220	225	230	235	E. Long

TOTAL INTENSITY (F) WMM-95

E. Long	240	245	250	255	260	265	270	275	280	285	290	295	E. Long
Lat													Lat
0	31505.8 -36.2	31520.1 -35.6	31571.3 -34.5	31634.9 -33.6	31678.7 -33.9	31667.7 -35.9	31570.8 -40.3	31365.8 -47.0	31043.3 -55.6	30608.6 -64.9	30081.9 -73.4	29496.6 -78.9	0
-5	30800.0 -35.9	30609.4 -36.1	30458.9 -35.7	30325.2 -35.2	30179.2 -35.4	29991.3 -37.1	29738.2 -40.6	29406.1 -45.9	28993.5 -52.8	28511.9 -60.1	27985.8 -66.6	27449.7 -70.4	-5
-10	30796.8 -36.6	30405.8 -37.6	30052.4 -37.7	29712.7 -37.6	29358.9 -37.9	28965.9 -39.2	28518.3 -42.0	28013.4 -46.1	27462.4 -51.2	26888.3 -56.4	26323.7 -60.6	25806.8 -62.3	-10
-15	31470.3 -38.0	30884.2 -39.9	30327.2 -40.6	29775.5 -40.8	29202.3 -41.2	28586.5 -42.3	27919.6 -44.4	27210.5 -47.3	26484.3 -50.7	25779.0 -53.9	25138.5 -55.7	24606.5 -55.4	-15
-20	32745.6 -40.3	31969.2 -43.0	31207.2 -44.4	30438.0 -45.0	29638.6 -45.5	28792.4 -46.3	27897.7 -47.6	26972.5 -49.4	26054.4 -51.1	25194.6 -52.2	24449.0 -52.1	23867.8 -50.0	-20
-25	34516.0 -43.7	33554.8 -47.2	32586.8 -49.4	31596.9 -50.6	30569.3 -51.2	29494.4 -51.6	28377.5 -52.1	27243.7 -52.4	26138.3 -52.3	25121.0 -51.5	24255.6 -49.5	23597.2 -46.1	-25
-30	36656.8 -48.9	35520.8 -53.1	34353.2 -56.0	33147.8 -57.8	31899.4 -58.5	30608.7 -58.4	29288.7 -57.8	27969.5 -56.6	26699.4 -54.6	25540.0 -51.9	24556.5 -48.2	23804.6 -43.9	-30
-35	39041.3 -55.9	37750.5 -60.6	36403.5 -64.2	35004.4 -66.4	33559.7 -67.1	32081.6 -66.6	30591.2 -64.9	29122.5 -62.1	27723.0 -58.4	26450.4 -53.8	25364.2 -48.8	24515.6 -43.7	-35
-40	41558.3 -64.6	40146.0 -69.5	38658.3 -73.3	37108.0 -75.7	35512.5 -76.4	33893.9 -75.3	32280.5 -72.7	30708.6 -68.7	29222.7 -63.6	27872.6 -57.7	26708.2 -51.6	25771.2 -46.0	-40
-45	44125.9 -73.8	42638.3 -78.6	41065.1 -82.4	39425.2 -84.6	37742.9 -85.1	36046.9 -83.6	34370.1 -80.4	32748.9 -75.7	31223.4 -69.7	29834.6 -63.2	28621.0 -56.7	27613.3 -50.9	-45
-50	46691.7 -81.9	45183.7 -86.3	43590.2 -89.7	41932.3 -91.6	40237.2 -91.8	38535.6 -90.2	36861.1 -86.8	35248.2 -81.9	33731.4 -76.0	32343.5 -69.5	31112.6 -63.3	30059.7 -57.9	-50
-55	49211.9 -87.3	47741.0 -91.2	46193.2 -94.0	44589.1 -95.6	42954.5 -95.6	41318.2 -94.0	39710.8 -90.8	38162.5 -86.4	36701.9 -81.2	35354.6 -75.6	34140.9 -70.2	33074.9 -65.6	-55
-60	51618.7 -88.9	50239.5 -92.1	48797.7 -94.5	47310.9 -95.7	45801.0 -95.7	44292.0 -94.4	42809.0 -92.0	41376.6 -88.6	40017.2 -84.5	38750.3 -80.2	37590.7 -76.1	36548.7 -72.7	-60
-65	53794.6 -86.6	52556.3 -89.2	51271.3 -91.2	49953.5 -92.3	48619.5 -92.5	47287.3 -91.8	45975.9 -90.2	44703.4 -88.1	43486.4 -85.5	42339.3 -82.7	41273.4 -80.1	40296.4 -77.9	-65
-70	55576.4 -81.3	54521.8 -83.5	53435.0 -85.2	52326.1 -86.3	51206.6 -86.8	50089.0 -86.8	48986.0 -86.2	47910.2 -85.3	46873.1 -84.1	45884.7 -82.7	44953.7 -81.4	44086.3 -80.4	-70
-75	56792.5 -74.9	55958.0 -76.6	55102.7 -78.1	54233.4 -79.2	53357.7 -80.0	52483.3 -80.5	51618.2 -80.8	50770.5 -80.8	49947.5 -80.6	49156.1 -80.4	48402.4 -80.1	47691.6 -79.9	-75
-80	57316.4 -69.1	56732.9 -70.4	56136.9 -71.6	55532.7 -72.6	54924.8 -73.5	54317.8 -74.3	53716.2 -74.9	53124.8 -75.4	52548.0 -75.8	51990.2 -76.1	51455.4 -76.4	50947.5 -76.7	-80
-85	57112.0 -65.5	56806.8 -66.2	56495.7 -66.9	56180.6 -67.6	55863.9 -68.2	55547.8 -68.8	55234.5 -69.3	54926.3 -69.8	54625.5 -70.2	54334.2 -70.6	54054.5 -71.0	53788.4 -71.3	-85
-90	56246.8 -64.5	56246.8 -64.5	56246.8 -64.5	56246.8 -64.5	56246.8 -64.5	56246.8 -64.5	56246.8 -64.5	56246.8 -64.5	56246.8 -64.5	56246.8 -64.5	56246.8 -64.5	56246.8 -64.5	-90
Lat													Lat
E. Long	240	245	250	255	260	265	270	275	280	285	290	295	E. Long

TOTAL INTENSITY (F) WMM-95

E. Long / Lat	300	305	310	315	320	325	330	335	340	345	350	355	E. Long / Lat
0	28896.1 -79.9	28330.9 -75.2	27857.6 -64.9	27533.5 -50.6	27404.6 -34.3	27489.4 -18.7	27771.0 -5.7	28205.2 3.7	28741.8 9.4	29341.3 11.7	29979.4 11.4	30637.4 9.1	0
-5	26944.8 -69.9	26515.7 -64.4	26208.2 -54.0	26065.1 -40.1	26116.0 -24.8	26365.3 -10.5	26787.9 1.2	27340.0 9.3	27978.1 13.7	28672.4 14.6	29404.6 12.7	30156.5 8.5	-5
-10	25376.1 -60.2	25067.2 -53.9	24910.1 -43.8	24926.5 -31.2	25124.7 -18.0	25493.3 -5.9	26002.5 3.7	26614.5 10.1	27298.1 13.1	28035.9 12.9	28816.3 9.7	29620.0 3.9	-10
-15	24219.4 -52.0	24001.6 -45.4	23964.0 -36.2	24104.4 -25.7	24407.7 -15.2	24847.5 -6.0	25390.9 1.0	26007.8 5.3	26680.2 6.8	27401.3 5.4	28165.3 1.1	28952.1 -5.9	-15
-20	23486.1 -45.7	23318.3 -39.4	23357.2 -31.8	23577.8 -23.8	23943.6 -16.5	24414.0 -10.6	24952.5 -6.6	25533.9 -4.7	26148.5 -5.1	26796.5 -7.9	27476.0 -13.3	28168.5 -21.2	-20
-25	23181.0 -41.5	23014.6 -35.9	23077.5 -30.2	23327.9 -25.0	23712.3 -21.1	24178.1 -18.7	24683.1 -18.0	25202.1 -18.9	25727.2 -21.6	26261.1 -26.2	26804.1 -32.7	27342.4 -41.1	-25
-30	23318.9 -39.1	23103.8 -34.6	23132.6 -30.9	23354.5 -28.6	23706.7 -27.9	24128.4 -29.0	24571.6 -31.7	25007.0 -35.8	25424.3 -41.1	25824.4 -47.5	26209.2 -55.1	26571.5 -63.5	-30
-35	23935.8 -39.0	23627.8 -35.5	23564.8 -33.6	23695.9 -33.8	23957.7 -36.2	24287.2 -40.4	24633.6 -46.3	24963.9 -53.3	25263.3 -61.0	25530.0 -69.2	25766.6 -77.5	25973.2 -85.4	-35
-40	25086.5 -41.5	24655.8 -38.8	24455.8 -38.4	24442.1 -40.5	24558.3 -45.1	24747.0 -51.7	24959.9 -60.0	25163.4 -69.2	25340.6 -78.7	25487.2 -87.9	25606.8 -96.3	25706.1 -103.2	-40
-45	26828.7 -46.7	26267.2 -44.6	25909.9 -45.0	25722.0 -48.2	25659.1 -54.0	25674.8 -61.9	25729.0 -71.3	25792.4 -81.5	25849.0 -91.6	25894.8 -100.9	25934.5 -108.6	25979.3 -114.0	-45
-50	29195.5 -54.1	28518.1 -52.4	28013.3 -53.2	27656.0 -56.5	27414.6 -62.3	27256.1 -70.1	27151.2 -79.2	27078.5 -88.9	27026.0 -98.3	26991.6 -106.5	26981.6 -112.9	27009.3 -116.6	-50
-55	32162.9 -62.4	31403.0 -61.0	30785.0 -61.8	30292.4 -64.7	29904.8 -69.6	29601.3 -76.1	29363.5 -83.7	29177.9 -91.6	29037.9 -99.2	28943.9 -105.7	28903.3 -110.4	28929.3 -112.7	-55
-60	35628.6 -70.3	34829.6 -69.2	34145.8 -69.7	33567.7 -71.8	33083.7 -75.4	32682.2 -80.1	32353.3 -85.5	32090.3 -91.2	31890.8 -96.5	31757.5 -101.0	31697.4 -104.1	31722.2 -105.5	-60
-65	39412.6 -76.3	38622.9 -75.6	37925.5 -75.9	37316.3 -77.2	36790.3 -79.4	36342.4 -82.4	35968.8 -85.7	35667.3 -89.2	35438.4 -92.5	35285.7 -95.3	35215.4 -97.1	35236.2 -97.8	-65
-70	43287.1 -79.6	42558.6 -79.4	41902.1 -79.6	41317.4 -80.3	40804.0 -81.5	40361.2 -83.0	39988.9 -84.8	39687.7 -86.7	39459.8 -88.4	39308.5 -89.8	39238.5 -90.7	39256.0 -91.1	-70
-75	47028.1 -79.8	46415.4 -79.9	45856.1 -80.1	45352.4 -80.6	44906.4 -81.1	44519.5 -81.9	44193.7 -82.6	43931.0 -83.4	43733.7 -84.1	43604.7 -84.7	43547.2 -85.0	43564.5 -85.1	-75
-80	50469.8 -77.0	50025.7 -77.3	49617.8 -77.5	49249.0 -77.8	48921.6 -78.1	48637.9 -78.4	48399.9 -78.7	48209.7 -79.0	48069.2 -79.1	47980.2 -79.2	47944.6 -79.3	47963.8 -79.1	-80
-85	53538.1 -71.6	53305.2 -71.9	53091.6 -72.1	52898.9 -72.3	52728.6 -72.5	52582.0 -72.6	52460.5 -72.7	52365.1 -72.7	52296.8 -72.7	52256.3 -72.6	52244.2 -72.5	52260.9 -72.4	-85
-90	56246.8 -64.5	56246.8 -64.5	56246.8 -64.5	56246.8 -64.5	56246.8 -64.5	56246.8 -64.5	56246.8 -64.5	56246.8 -64.5	56246.8 -64.5	56246.8 -64.5	56246.8 -64.5	56246.8 -64.5	-90
Lat													Lat
E. Long	300	305	310	315	320	325	330	335	340	345	350	355	E. Long

DECLINATION (D) WMM-95

E. Long	0	5	10	15	20	25	30	35	40	45	50	55	E. Long
Lat													Lat
90	-30.6	-25.6	-20.6	-15.6	-10.6	-5.6	-0.6	4.4	9.4	14.4	19.4	24.4	90
	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	
85	-15.6	-11.1	-6.6	-2.2	2.2	6.4	10.6	14.8	18.8	22.7	26.6	30.2	85
	15.2	14.8	14.4	14.2	13.9	13.8	13.7	13.7	13.7	13.8	14.0	14.3	
80	-11.7	-7.5	-3.4	0.7	4.7	8.7	12.5	16.2	19.8	23.3	26.6	29.7	80
	11.2	10.6	10.1	9.7	9.3	9.0	8.8	8.6	8.5	8.5	8.6	8.7	
75	-9.8	-6.0	-2.2	1.5	5.1	8.7	12.1	15.4	18.5	21.5	24.2	26.7	75
	9.5	8.8	8.2	7.7	7.2	6.8	6.5	6.3	6.1	6.0	5.9	5.9	
70	-8.4	-4.9	-1.6	1.7	4.8	7.9	10.8	13.6	16.3	18.7	20.9	22.8	70
	8.5	7.8	7.1	6.5	5.9	5.5	5.1	4.8	4.5	4.4	4.3	4.2	
65	-7.0	-4.0	-1.2	1.6	4.3	6.9	9.3	11.6	13.7	15.7	17.4	18.8	65
	7.8	7.1	6.3	5.6	5.0	4.5	4.0	3.7	3.4	3.2	3.1	3.1	
60	-5.8	-3.2	-0.8	1.5	3.7	5.8	7.8	9.6	11.3	12.7	14.0	15.0	60
	7.3	6.6	5.8	5.0	4.3	3.7	3.2	2.8	2.5	2.4	2.3	2.2	
55	-4.6	-2.4	-0.4	1.5	3.2	4.8	6.4	7.8	9.0	10.1	11.0	11.7	55
	7.1	6.3	5.4	4.5	3.7	3.0	2.5	2.1	1.8	1.7	1.6	1.6	
50	-3.7	-1.8	-0.1	1.4	2.8	4.0	5.2	6.2	7.1	7.9	8.5	8.9	50
	6.9	6.1	5.1	4.1	3.2	2.4	1.9	1.5	1.3	1.2	1.2	1.2	
45	-2.9	-1.3	0.1	1.3	2.4	3.4	4.2	5.0	5.6	6.1	6.4	6.6	45
	6.8	5.9	4.9	3.8	2.8	2.0	1.4	1.1	1.0	0.9	0.9	0.9	
40	-2.5	-1.0	0.2	1.2	2.1	2.8	3.5	4.0	4.5	4.7	4.8	4.7	40
	6.7	5.8	4.6	3.4	2.4	1.6	1.1	0.9	0.8	0.8	0.8	0.7	
35	-2.2	-0.9	0.2	1.0	1.7	2.3	2.9	3.3	3.6	3.7	3.6	3.3	35
	6.6	5.6	4.3	3.1	2.1	1.4	1.0	0.9	0.9	0.9	0.8	0.6	
30	-2.3	-1.0	0.0	0.7	1.4	1.9	2.4	2.8	3.0	2.9	2.6	2.2	30
	6.5	5.3	4.0	2.8	1.8	1.3	1.1	1.1	1.2	1.1	0.9	0.5	
25	-2.6	-1.3	-0.4	0.4	1.0	1.6	2.1	2.4	2.5	2.3	1.9	1.3	25
	6.3	5.1	3.8	2.6	1.7	1.3	1.3	1.4	1.5	1.4	1.0	0.5	
20	-3.0	-1.8	-0.8	-0.1	0.6	1.2	1.7	2.1	2.2	1.9	1.3	0.6	20
	6.1	4.9	3.6	2.4	1.7	1.4	1.5	1.8	1.9	1.7	1.1	0.4	
15	-3.7	-2.5	-1.5	-0.6	0.1	0.8	1.4	1.7	1.8	1.4	0.7	-0.1	15
	6.1	4.8	3.5	2.4	1.8	1.7	1.9	2.1	2.2	1.8	1.1	0.3	
10	-4.7	-3.4	-2.3	-1.3	-0.5	0.3	1.0	1.4	1.3	0.8	0.0	-0.9	10
	6.1	4.9	3.6	2.7	2.1	2.1	2.2	2.4	2.3	1.8	0.9	0.0	
5	-6.1	-4.6	-3.3	-2.2	-1.2	-0.3	0.5	0.8	0.7	0.1	-0.8	-1.9	5
	6.4	5.2	4.0	3.1	2.6	2.5	2.6	2.6	2.3	1.5	0.5	-0.5	
0	-8.0	-6.3	-4.8	-3.4	-2.1	-1.1	-0.3	0.1	-0.2	-1.0	-2.1	-3.3	0
	6.8	5.8	4.7	3.8	3.3	3.0	2.9	2.6	1.9	0.9	-0.3	-1.3	
Lat													Lat
E. Long	0	5	10	15	20	25	30	35	40	45	50	55	E. Long

DECLINATION (D) WMM-95

E. Long	60	65	70	75	80	85	90	95	100	105	110	115	E. Long
Lat 90	29.4 29.9	34.4 29.9	39.4 29.9	44.4 29.9	49.4 29.9	54.4 29.9	59.4 29.9	64.4 29.9	69.4 29.9	74.4 29.9	79.4 29.9	84.4 29.9	Lat 90
85	33.8 14.7	37.1 15.2	40.3 15.7	43.2 16.4	45.8 17.2	48.1 18.2	49.9 19.2	51.3 20.3	52.0 21.4	52.1 22.4	51.4 23.0	49.9 23.0	85
80	32.5 8.9	34.9 9.2	37.0 9.6	38.6 10.1	39.4 10.7	39.4 11.3	38.3 11.9	35.8 12.2	31.6 12.0	25.7 10.7	18.6 8.1	11.0 4.6	80
75	28.8 6.0	30.5 6.2	31.7 6.4	32.1 6.6	31.7 6.9	30.1 7.1	27.2 7.1	22.6 6.8	16.6 5.8	9.4 4.3	2.0 2.3	-4.6 0.5	75
70	24.3 4.2	25.4 4.3	25.9 4.4	25.6 4.5	24.4 4.6	22.2 4.7	18.8 4.5	14.1 4.2	8.3 3.5	2.1 2.5	-3.9 1.4	-9.1 0.4	70
65	19.8 3.1	20.4 3.1	20.4 3.2	19.8 3.3	18.4 3.4	16.2 3.4	13.0 3.4	8.9 3.2	4.1 2.8	-0.9 2.2	-5.7 1.5	-9.9 0.8	65
60	15.7 2.2	16.0 2.3	15.8 2.4	15.1 2.6	13.7 2.8	11.7 2.9	9.0 3.1	5.7 3.0	1.9 2.8	-2.1 2.4	-6.0 1.9	-9.4 1.2	60
55	12.1 1.7	12.2 1.8	11.9 2.0	11.2 2.2	10.1 2.5	8.5 2.8	6.3 3.1	3.7 3.2	0.7 3.0	-2.5 2.7	-5.7 2.2	-8.5 1.6	55
50	9.0 1.3	9.0 1.4	8.7 1.6	8.2 2.0	7.3 2.4	6.0 2.8	4.4 3.2	2.3 3.4	0.0 3.3	-2.5 3.0	-5.1 2.5	-7.5 1.8	50
45	6.6 0.9	6.4 1.1	6.1 1.4	5.7 1.8	5.0 2.3	4.1 2.9	2.9 3.4	1.4 3.6	-0.4 3.5	-2.4 3.2	-4.4 2.6	-6.4 1.9	45
40	4.6 0.6	4.3 0.8	4.1 1.1	3.7 1.6	3.3 2.3	2.6 3.0	1.8 3.5	0.7 3.8	-0.6 3.7	-2.1 3.2	-3.7 2.6	-5.4 1.8	40
35	3.0 0.4	2.7 0.5	2.4 0.8	2.2 1.4	1.9 2.2	1.5 3.0	0.9 3.6	0.2 3.8	-0.7 3.7	-1.8 3.2	-3.1 2.4	-4.4 1.5	35
30	1.8 0.2	1.4 0.2	1.1 0.5	0.9 1.2	0.7 2.1	0.5 3.0	0.3 3.6	-0.1 3.9	-0.7 3.6	-1.5 2.9	-2.4 2.0	-3.4 1.1	30
25	0.8 0.0	0.4 -0.1	0.1 0.3	-0.1 1.0	-0.2 2.0	-0.2 3.0	-0.3 3.7	-0.4 3.9	-0.7 3.5	-1.1 2.6	-1.7 1.6	-2.5 0.5	25
20	0.0 -0.1	-0.5 -0.3	-0.8 0.0	-0.9 0.9	-0.9 2.0	-0.8 3.1	-0.7 3.8	-0.6 3.8	-0.6 3.3	-0.8 2.3	-1.1 1.1	-1.6 0.0	20
15	-0.8 -0.4	-1.3 -0.6	-1.6 -0.1	-1.7 0.8	-1.6 2.1	-1.4 3.2	-1.1 3.9	-0.7 3.9	-0.5 3.2	-0.4 2.0	-0.6 0.7	-0.8 -0.5	15
10	-1.7 -0.7	-2.3 -0.8	-2.5 -0.3	-2.5 0.8	-2.3 2.2	-1.9 3.4	-1.4 4.0	-0.9 3.9	-0.4 3.1	-0.1 1.8	-0.1 0.3	-0.1 -0.9	10
5	-2.8 -1.2	-3.4 -1.1	-3.6 -0.4	-3.5 0.9	-3.2 2.4	-2.6 3.6	-1.9 4.3	-1.2 4.1	-0.5 3.1	0.1 1.7	0.3 0.2	0.5 -1.1	5
0 Lat	-4.2 -1.8	-4.8 -1.5	-5.0 -0.5	-4.8 1.0	-4.3 2.6	-3.6 3.9	-2.6 4.6	-1.6 4.3	-0.7 3.3	0.1 1.8	0.6 0.2	0.9 -1.0	0 Lat
E. Long	60	65	70	75	80	85	90	95	100	105	110	115	E. Long

DECLINATION (D) WMM-95

E. Long	120	125	130	135	140	145	150	155	160	165	170	175	E. Long
Lat 90	89.4 29.9	94.4 29.9	99.4 29.9	104.4 29.9	109.4 29.9	114.4 29.9	119.4 29.9	124.4 29.9	129.4 29.9	134.4 29.9	139.4 29.9	144.4 29.9	Lat 90
85	47.7 22.0	44.8 19.8	41.6 16.2	38.5 11.7	35.7 6.7	33.7 1.8	32.5 -2.6	32.2 -6.4	32.8 -9.6	34.3 -12.4	36.5 -14.7	39.3 -16.8	85
80	4.2 1.0	-1.2 -2.0	-4.8 -4.1	-6.7 -5.5	-7.2 -6.4	-6.6 -7.1	-5.2 -7.7	-3.1 -8.2	-0.5 -8.8	2.5 -9.4	5.9 -10.1	9.5 -11.0	80
75	-9.7 -1.0	-13.1 -2.0	-14.9 -2.6	-15.5 -3.1	-14.9 -3.4	-13.5 -3.7	-11.5 -4.0	-8.9 -4.4	-6.0 -4.9	-2.7 -5.5	0.8 -6.1	4.5 -6.9	75
70	-13.0 -0.4	-15.6 -0.9	-16.9 -1.3	-17.0 -1.6	-16.3 -1.9	-14.8 -2.1	-12.8 -2.4	-10.2 -2.8	-7.3 -3.3	-4.0 -3.8	-0.6 -4.5	3.0 -5.3	70
65	-13.1 0.2	-15.3 -0.2	-16.4 -0.6	-16.5 -0.9	-15.9 -1.1	-14.5 -1.4	-12.5 -1.7	-10.1 -2.1	-7.3 -2.5	-4.2 -3.1	-0.9 -3.9	2.5 -4.7	65
60	-12.2 0.7	-14.1 0.2	-15.1 -0.2	-15.3 -0.5	-14.7 -0.8	-13.5 -1.1	-11.7 -1.4	-9.4 -1.8	-6.8 -2.3	-3.8 -2.9	-0.7 -3.6	2.5 -4.5	60
55	-10.9 1.0	-12.6 0.4	-13.5 -0.1	-13.8 -0.5	-13.3 -0.8	-12.2 -1.2	-10.5 -1.5	-8.4 -1.9	-5.9 -2.4	-3.2 -3.0	-0.3 -3.7	2.7 -4.5	55
50	-9.5 1.1	-11.0 0.5	-11.9 -0.1	-12.1 -0.5	-11.7 -1.0	-10.7 -1.4	-9.1 -1.8	-7.2 -2.3	-4.9 -2.8	-2.4 -3.3	0.4 -3.9	3.1 -4.6	50
45	-8.2 1.1	-9.5 0.5	-10.2 -0.2	-10.4 -0.7	-10.0 -1.2	-9.1 -1.7	-7.6 -2.2	-5.8 -2.7	-3.7 -3.2	-1.3 -3.8	1.2 -4.3	3.8 -4.8	45
40	-6.8 1.0	-7.9 0.3	-8.6 -0.3	-8.7 -0.9	-8.3 -1.4	-7.4 -2.0	-6.0 -2.6	-4.3 -3.2	-2.2 -3.7	0.0 -4.2	2.3 -4.6	4.7 -4.9	40
35	-5.5 0.7	-6.4 0.0	-6.9 -0.5	-7.0 -1.0	-6.5 -1.5	-5.6 -2.1	-4.3 -2.8	-2.6 -3.4	-0.7 -4.1	1.4 -4.6	3.6 -4.9	5.7 -5.1	35
30	-4.3 0.3	-5.0 -0.3	-5.4 -0.8	-5.3 -1.1	-4.7 -1.5	-3.8 -2.0	-2.5 -2.7	-0.8 -3.4	1.0 -4.1	3.0 -4.7	4.9 -5.0	6.7 -5.0	30
25	-3.2 -0.3	-3.7 -0.7	-3.8 -1.0	-3.6 -1.1	-3.0 -1.3	-2.0 -1.7	-0.7 -2.3	0.9 -3.1	2.7 -3.8	4.5 -4.5	6.2 -4.8	7.7 -4.9	25
20	-2.1 -0.8	-2.4 -1.1	-2.4 -1.1	-2.0 -1.0	-1.3 -1.0	-0.3 -1.2	1.1 -1.7	2.6 -2.4	4.2 -3.3	5.8 -4.0	7.3 -4.4	8.6 -4.6	20
15	-1.1 -1.2	-1.2 -1.4	-1.1 -1.2	-0.6 -0.9	0.2 -0.5	1.3 -0.5	2.6 -0.9	4.0 -1.7	5.5 -2.5	7.0 -3.4	8.2 -4.0	9.2 -4.3	15
10	-0.2 -1.6	-0.2 -1.7	0.1 -1.3	0.7 -0.6	1.6 -0.1	2.7 0.0	3.9 -0.2	5.3 -0.9	6.6 -1.8	7.9 -2.7	8.9 -3.5	9.6 -4.0	10
5	0.5 -1.7	0.7 -1.7	1.1 -1.2	1.8 -0.4	2.7 0.2	3.8 0.5	5.0 0.3	6.2 -0.3	7.5 -1.3	8.6 -2.2	9.4 -3.1	10.0 -3.7	5
0 Lat	1.1 -1.6	1.4 -1.6	1.9 -1.0	2.7 -0.2	3.7 0.5	4.7 0.8	5.9 0.6	7.0 0.0	8.2 -0.9	9.1 -1.9	9.9 -2.7	10.3 -3.4	0 Lat
E. Long	120	125	130	135	140	145	150	155	160	165	170	175	E. Long

DECLINATION (D) WMM-95

E. Long Lat	180	185	190	195	200	205	210	215	220	225	230	235	E. Long Lat
90	149.4 29.9	154.4 29.9	159.4 29.9	164.4 29.9	169.4 29.9	174.4 29.9	179.4 29.9	-175.6 29.9	-170.6 29.9	-165.6 29.9	-160.6 29.9	-155.6 29.9	90
85	42.9 -18.8	47.0 -20.7	51.7 -22.5	57.2 -24.2	63.4 -25.8	70.6 -26.8	79.0 -26.8	89.0 -24.5	101.3 -17.5	116.6 -2.1	135.1 23.7	155.9 53.7	85
80	13.3 -11.9	17.3 -13.1	21.4 -14.4	25.6 -16.0	30.0 -17.8	34.4 -20.1	38.9 -22.8	43.5 -26.2	48.2 -30.6	53.1 -36.5	58.1 -44.8	63.5 -57.5	80
75	8.3 -7.8	12.2 -8.8	16.1 -10.0	20.1 -11.3	24.0 -12.7	27.9 -14.4	31.7 -16.4	35.4 -18.7	38.9 -21.4	42.1 -24.9	45.0 -29.3	47.3 -35.4	75
70	6.7 -6.3	10.4 -7.3	14.1 -8.4	17.8 -9.6	21.4 -11.0	24.8 -12.4	28.0 -13.9	31.0 -15.6	33.7 -17.4	36.0 -19.6	37.8 -22.1	38.9 -25.3	70
65	6.0 -5.7	9.5 -6.7	13.0 -7.8	16.3 -9.0	19.5 -10.2	22.5 -11.3	25.2 -12.5	27.6 -13.7	29.7 -14.8	31.3 -16.0	32.3 -17.2	32.6 -18.6	65
60	5.8 -5.4	9.0 -6.5	12.2 -7.5	15.2 -8.6	18.0 -9.6	20.6 -10.6	22.8 -11.4	24.8 -12.1	26.3 -12.7	27.4 -13.1	27.9 -13.4	27.8 -13.6	60
55	5.8 -5.4	8.7 -6.3	11.6 -7.3	14.3 -8.2	16.7 -9.1	18.9 -9.8	20.7 -10.3	22.3 -10.6	23.4 -10.7	24.1 -10.5	24.3 -10.2	24.0 -9.8	55
50	5.9 -5.3	8.6 -6.1	11.1 -6.9	13.5 -7.7	15.6 -8.4	17.4 -8.9	18.9 -9.2	20.1 -9.2	21.0 -8.9	21.4 -8.3	21.5 -7.6	21.1 -6.8	50
45	6.3 -5.3	8.7 -5.9	10.9 -6.5	12.8 -7.0	14.6 -7.5	16.1 -7.9	17.3 -7.9	18.2 -7.7	18.9 -7.2	19.2 -6.4	19.2 -5.5	18.7 -4.6	45
40	6.9 -5.2	8.9 -5.5	10.7 -5.9	12.3 -6.2	13.7 -6.5	14.8 -6.7	15.8 -6.7	16.5 -6.3	17.0 -5.7	17.3 -4.8	17.2 -3.8	16.8 -2.8	40
35	7.6 -5.1	9.2 -5.2	10.6 -5.2	11.8 -5.3	12.8 -5.5	13.6 -5.5	14.4 -5.4	14.9 -5.0	15.3 -4.3	15.5 -3.4	15.4 -2.3	15.1 -1.4	35
30	8.3 -5.0	9.6 -4.8	10.5 -4.6	11.3 -4.5	11.9 -4.5	12.5 -4.4	13.0 -4.2	13.4 -3.7	13.7 -3.0	13.8 -2.1	13.8 -1.2	13.6 -0.4	30
25	9.0 -4.7	9.8 -4.5	10.4 -4.2	10.7 -3.9	11.0 -3.7	11.3 -3.4	11.7 -3.1	12.0 -2.5	12.2 -1.8	12.3 -1.0	12.3 -0.2	12.2 0.5	25
20	9.4 -4.5	9.9 -4.3	10.1 -3.9	10.2 -3.6	10.2 -3.2	10.3 -2.7	10.5 -2.2	10.8 -1.5	10.9 -0.8	11.0 0.0	11.0 0.6	10.9 1.1	20
15	9.8 -4.3	10.0 -4.2	9.9 -3.8	9.7 -3.4	9.6 -2.9	9.6 -2.2	9.6 -1.5	9.8 -0.6	9.9 0.2	10.0 0.8	10.0 1.3	10.0 1.6	15
10	10.0 -4.2	9.9 -4.1	9.7 -3.9	9.4 -3.4	9.2 -2.7	9.1 -1.9	9.1 -0.9	9.2 0.1	9.3 0.9	9.3 1.6	9.3 1.9	9.3 1.9	10
5	10.1 -4.0	10.0 -4.1	9.7 -3.9	9.3 -3.4	9.0 -2.6	8.9 -1.6	8.9 -0.5	8.9 0.7	9.0 1.6	9.0 2.2	9.0 2.4	9.0 2.2	5
0	10.4 -3.8	10.2 -4.0	9.8 -3.9	9.5 -3.4	9.2 -2.6	9.1 -1.4	9.1 -0.1	9.1 1.1	9.1 2.1	9.1 2.7	9.1 2.8	9.1 2.4	0
Lat E. Long	180	185	190	195	200	205	210	215	220	225	230	235	Lat E. Long

DECLINATION (D) WMM-95

E. Long Lat	240	245	250	255	260	265	270	275	280	285	290	295	E. Long Lat
90	-150.6 29.9	-145.6 29.9	-140.6 29.9	-135.6 29.9	-130.6 29.9	-125.6 29.9	-120.6 29.9	-115.6 29.9	-110.6 29.9	-105.6 29.9	-100.6 29.9	-95.6 29.9	90
85	176.4 73.9	-165.6 78.9	-150.7 74.5	-138.6 66.8	-128.4 59.1	-119.5 52.3	-111.7 46.6	-104.6 41.8	-98.0 37.8	-91.8 34.5	-85.8 31.6	-80.1 29.2	85
80	69.6 -79.4	77.9 -125.5	96.8 -267.4	-143.0 477.2	-111.3 167.9	-101.8 98.5	-95.2 69.8	-89.6 54.3	-84.5 44.6	-79.5 37.9	-74.7 33.0	-70.0 29.3	80
75	48.6 -44.1	48.1 -57.5	43.6 -78.6	28.3 -101.6	-11.2 -26.7	-48.8 67.5	-62.6 64.9	-66.6 52.6	-66.9 43.3	-65.4 36.6	-63.0 31.7	-60.0 28.0	75
70	38.8 -29.1	37.0 -33.8	32.4 -38.7	23.0 -40.5	7.1 -29.9	-13.5 -2.4	-31.4 21.2	-42.5 29.8	-48.2 30.5	-50.5 28.7	-50.8 26.5	-49.8 24.3	70
65	31.9 -20.0	29.8 -21.5	25.7 -22.5	19.0 -22.0	9.2 -18.0	-3.1 -9.2	-15.7 2.0	-26.2 11.0	-33.5 16.2	-37.8 18.5	-40.0 19.2	-40.6 19.0	65
60	26.8 -13.8	24.7 -13.9	21.3 -13.9	16.2 -13.4	9.2 -11.8	0.8 -8.5	-8.3 -3.5	-16.8 2.0	-23.6 6.8	-28.5 10.3	-31.6 12.5	-33.0 13.8	60
55	23.0 -9.4	21.1 -9.0	18.2 -8.9	14.2 -8.7	8.9 -8.4	2.6 -7.3	-4.4 -5.3	-11.3 -2.2	-17.3 1.3	-22.1 4.6	-25.4 7.4	-27.3 9.5	55
50	20.1 -6.2	18.5 -5.7	16.1 -5.7	12.8 -5.9	8.6 -6.3	3.5 -6.5	-2.1 -5.9	-7.9 -4.4	-13.2 -2.0	-17.6 0.9	-20.9 3.7	-23.1 6.1	50
45	17.9 -3.8	16.5 -3.4	14.5 -3.5	11.7 -4.1	8.3 -5.0	4.1 -5.9	-0.6 -6.2	-5.6 -5.7	-10.3 -4.1	-14.5 -1.8	-17.8 0.9	-20.0 3.5	45
40	16.1 -2.1	14.9 -1.8	13.2 -2.1	10.9 -2.9	8.0 -4.1	4.4 -5.4	0.4 -6.4	-4.0 -6.6	-8.3 -5.7	-12.2 -3.8	-15.4 -1.3	-17.8 1.3	40
35	14.5 -0.8	13.5 -0.6	12.1 -1.0	10.2 -2.0	7.7 -3.5	4.6 -5.1	1.1 -6.5	-2.8 -7.2	-6.7 -6.8	-10.4 -5.4	-13.6 -3.2	-16.0 -0.7	35
30	13.1 0.1	12.3 0.2	11.2 -0.4	9.6 -1.5	7.5 -3.0	4.8 -4.8	1.7 -6.4	-1.8 -7.5	-5.4 -7.7	-9.0 -6.8	-12.1 -5.0	-14.7 -2.6	30
25	11.8 0.8	11.2 0.7	10.4 0.1	9.1 -1.1	7.3 -2.6	5.0 -4.5	2.2 -6.3	-1.0 -7.7	-4.4 -8.4	-7.8 -8.0	-10.9 -6.6	-13.6 -4.4	25
20	10.7 1.2	10.3 1.0	9.7 0.3	8.7 -0.8	7.2 -2.3	5.3 -4.1	2.8 -6.0	-0.1 -7.7	-3.3 -8.8	-6.7 -8.9	-9.9 -8.0	-12.7 -6.2	20
15	9.9 1.5	9.7 1.1	9.2 0.4	8.5 -0.6	7.3 -2.0	5.6 -3.7	3.4 -5.6	0.7 -7.5	-2.4 -9.0	-5.7 -9.6	-8.9 -9.3	-11.9 -7.8	15
10	9.3 1.6	9.2 1.1	9.0 0.4	8.5 -0.6	7.5 -1.8	6.1 -3.4	4.1 -5.2	1.6 -7.1	-1.4 -8.9	-4.7 -10.0	-8.0 -10.2	-11.2 -9.3	10
5	9.1 1.7	9.1 1.0	9.0 0.3	8.6 -0.6	7.9 -1.7	6.7 -3.0	4.9 -4.7	2.5 -6.6	-0.4 -8.6	-3.7 -10.1	-7.2 -10.8	-10.5 -10.4	5
0	9.2 1.7	9.2 0.9	9.2 0.1	8.9 -0.7	8.4 -1.5	7.3 -2.7	5.7 -4.1	3.4 -6.0	0.6 -8.0	-2.7 -9.9	-6.3 -11.1	-9.9 -11.2	0
Lat E. Long	240	245	250	255	260	265	270	275	280	285	290	295	Lat E. Long

DECLINATION (D) WMM-95

E. Long	300	305	310	315	320	325	330	335	340	345	350	355	E. Long
Lat													Lat
90	-90.6 29.9	-85.6 29.9	-80.6 29.9	-75.6 29.9	-70.6 29.9	-65.6 29.9	-60.6 29.9	-55.6 29.9	-50.6 29.9	-45.6 29.9	-40.6 29.9	-35.6 29.9	90
85	-74.6 27.2	-69.2 25.4	-64.0 23.8	-58.8 22.4	-53.8 21.2	-48.8 20.1	-43.9 19.1	-39.0 18.3	-34.2 17.5	-29.5 16.8	-24.8 16.2	-20.2 15.7	85
80	-65.3 26.3	-60.6 23.9	-56.0 21.8	-51.5 20.1	-46.9 18.6	-42.4 17.3	-37.9 16.1	-33.5 15.1	-29.0 14.1	-24.7 13.3	-20.3 12.5	-16.0 11.8	80
75	-56.7 25.1	-53.1 22.7	-49.4 20.7	-45.5 19.0	-41.6 17.5	-37.7 16.1	-33.7 14.9	-29.6 13.8	-25.6 12.8	-21.6 11.8	-17.6 11.0	-13.7 10.2	75
70	-48.0 22.3	-45.6 20.6	-42.8 19.0	-39.8 17.6	-36.5 16.3	-33.1 15.1	-29.6 14.0	-26.1 12.9	-22.5 11.9	-18.9 11.0	-15.4 10.1	-11.8 9.3	70
65	-40.0 18.4	-38.7 17.6	-36.7 16.7	-34.3 15.8	-31.7 14.8	-28.8 13.8	-25.8 12.9	-22.7 12.0	-19.5 11.1	-16.3 10.2	-13.2 9.4	-10.1 8.6	65
60	-33.3 14.3	-32.7 14.4	-31.4 14.2	-29.6 13.7	-27.4 13.1	-24.9 12.4	-22.3 11.7	-19.6 11.0	-16.8 10.2	-13.9 9.5	-11.1 8.8	-8.4 8.1	60
55	-28.1 10.8	-28.0 11.5	-27.1 11.8	-25.6 11.7	-23.8 11.4	-21.7 10.9	-19.3 10.4	-16.9 9.9	-14.4 9.4	-11.8 8.9	-9.3 8.4	-6.9 7.8	55
50	-24.2 7.9	-24.4 9.1	-23.8 9.7	-22.6 9.9	-21.0 9.9	-19.1 9.6	-17.0 9.3	-14.7 9.0	-12.4 8.7	-10.1 8.4	-7.9 8.0	-5.7 7.5	50
45	-21.3 5.6	-21.7 7.1	-21.4 8.0	-20.4 8.5	-18.9 8.6	-17.2 8.5	-15.2 8.3	-13.1 8.2	-11.0 8.1	-8.9 8.0	-6.7 7.8	-4.8 7.4	45
40	-19.2 3.6	-19.8 5.4	-19.7 6.6	-18.8 7.2	-17.6 7.5	-15.9 7.5	-14.1 7.6	-12.1 7.6	-10.1 7.7	-8.0 7.8	-6.0 7.7	-4.1 7.4	40
35	-17.7 1.8	-18.5 3.8	-18.5 5.2	-17.9 6.1	-16.8 6.6	-15.2 6.9	-13.5 7.0	-11.6 7.2	-9.6 7.5	-7.6 7.6	-5.7 7.6	-3.8 7.3	35
30	-16.6 0.0	-17.6 2.2	-17.9 4.0	-17.5 5.2	-16.5 5.9	-15.1 6.3	-13.4 6.7	-11.5 7.0	-9.6 7.4	-7.6 7.6	-5.6 7.6	-3.8 7.2	30
25	-15.7 -1.9	-17.0 0.6	-17.6 2.7	-17.4 4.2	-16.6 5.3	-15.3 6.0	-13.7 6.5	-11.9 6.9	-9.9 7.4	-7.9 7.6	-5.9 7.6	-4.1 7.2	25
20	-15.0 -3.7	-16.6 -1.1	-17.5 1.2	-17.7 3.2	-17.1 4.6	-16.0 5.6	-14.4 6.3	-12.6 6.9	-10.5 7.4	-8.4 7.7	-6.4 7.6	-4.6 7.1	20
15	-14.5 -5.6	-16.4 -2.9	-17.7 -0.3	-18.2 2.0	-17.9 3.8	-17.0 5.1	-15.5 6.1	-13.6 6.9	-11.5 7.5	-9.3 7.8	-7.2 7.6	-5.3 7.1	15
10	-14.0 -7.3	-16.3 -4.8	-17.9 -2.0	-18.8 0.6	-18.8 2.8	-18.1 4.5	-16.8 5.8	-14.9 6.8	-12.8 7.5	-10.6 7.8	-8.4 7.7	-6.4 7.1	10
5	-13.6 -8.9	-16.2 -6.5	-18.2 -3.7	-19.4 -1.0	-19.8 1.5	-19.4 3.6	-18.3 5.2	-16.5 6.5	-14.4 7.4	-12.2 7.9	-9.9 7.8	-7.9 7.3	5
0	-13.2 -10.1	-16.1 -8.1	-18.4 -5.5	-20.0 -2.7	-20.8 0.0	-20.8 2.3	-19.9 4.3	-18.4 5.8	-16.4 7.0	-14.2 7.7	-12.0 7.9	-9.9 7.6	0
Lat													Lat
E. Long	300	305	310	315	320	325	330	335	340	345	350	355	E. Long

DECLINATION (D) WMM-95

E. Long / Lat	0	5	10	15	20	25	30	35	40	45	50	55	E. Long / Lat
0	-8.0 6.8	-6.3 5.8	-4.8 4.7	-3.4 3.8	-2.1 3.3	-1.1 3.0	-0.3 2.9	0.1 2.6	-0.2 1.9	-1.0 0.9	-2.1 -0.3	-3.3 -1.3	0
-5	-10.4 7.4	-8.5 6.6	-6.7 5.6	-5.0 4.8	-3.4 4.1	-2.2 3.5	-1.4 3.0	-1.1 2.2	-1.6 1.2	-2.6 -0.1	-3.9 -1.4	-5.3 -2.3	-5
-10	-13.3 8.0	-11.2 7.5	-9.1 6.7	-7.1 5.8	-5.3 4.8	-3.9 3.8	-3.1 2.7	-3.1 1.3	-3.8 -0.2	-5.1 -1.7	-6.7 -2.9	-8.2 -3.5	-10
-15	-16.7 8.1	-14.5 8.1	-12.1 7.5	-9.8 6.6	-7.8 5.2	-6.4 3.6	-5.8 1.6	-6.2 -0.4	-7.3 -2.3	-9.0 -3.8	-10.7 -4.7	-12.2 -4.9	-15
-20	-20.0 7.5	-18.0 7.9	-15.6 7.6	-13.3 6.5	-11.3 4.7	-10.1 2.2	-10.0 -0.4	-10.8 -3.0	-12.4 -5.0	-14.4 -6.2	-16.2 -6.6	-17.7 -6.2	-20
-25	-22.8 6.2	-21.2 6.8	-19.1 6.5	-17.2 5.1	-15.7 2.7	-15.0 -0.4	-15.5 -3.5	-17.0 -6.0	-19.0 -7.7	-21.1 -8.3	-22.9 -8.1	-24.2 -7.3	-25
-30	-24.6 4.7	-23.4 4.9	-22.1 4.2	-20.9 2.3	-20.2 -0.5	-20.4 -3.8	-21.7 -6.6	-23.6 -8.6	-25.9 -9.6	-28.1 -9.6	-29.9 -9.0	-31.0 -8.0	-30
-35	-25.1 3.6	-24.5 3.0	-24.0 1.5	-23.7 -0.9	-24.1 -3.8	-25.2 -6.7	-27.1 -8.9	-29.5 -10.1	-32.0 -10.5	-34.3 -10.2	-36.1 -9.5	-37.3 -8.5	-35
-40	-24.4 3.1	-24.6 1.5	-24.9 -0.7	-25.6 -3.4	-26.8 -6.2	-28.7 -8.5	-31.1 -10.1	-33.8 -10.9	-36.6 -10.9	-39.0 -10.6	-41.1 -9.9	-42.6 -9.1	-40
-45	-23.1 2.7	-24.0 0.5	-25.1 -2.2	-26.6 -4.9	-28.6 -7.4	-31.1 -9.3	-33.9 -10.6	-36.8 -11.1	-39.8 -11.1	-42.5 -10.8	-44.9 -10.3	-46.9 -9.7	-45
-50	-21.7 2.4	-23.2 -0.1	-25.0 -2.8	-27.2 -5.3	-29.7 -7.5	-32.6 -9.2	-35.7 -10.3	-38.9 -10.9	-42.0 -11.0	-45.0 -10.8	-47.8 -10.5	-50.2 -10.1	-50
-55	-20.3 2.0	-22.4 -0.3	-24.8 -2.7	-27.5 -5.0	-30.4 -6.9	-33.6 -8.4	-36.9 -9.4	-40.3 -10.1	-43.7 -10.4	-47.0 -10.4	-50.1 -10.3	-53.0 -10.0	-55
-60	-19.3 1.6	-21.9 -0.3	-24.7 -2.3	-27.7 -4.1	-31.0 -5.7	-34.4 -7.0	-37.9 -8.0	-41.5 -8.7	-45.1 -9.2	-48.7 -9.4	-52.1 -9.4	-55.5 -9.4	-60
-65	-18.8 1.2	-21.8 -0.2	-24.9 -1.6	-28.2 -3.0	-31.7 -4.3	-35.2 -5.4	-38.9 -6.3	-42.7 -7.0	-46.5 -7.5	-50.3 -7.8	-54.1 -8.0	-57.8 -8.2	-65
-70	-18.8 0.9	-22.1 0.0	-25.5 -1.0	-29.0 -2.0	-32.7 -2.9	-36.5 -3.7	-40.3 -4.5	-44.3 -5.1	-48.2 -5.6	-52.3 -5.9	-56.3 -6.2	-60.4 -6.4	-70
-75	-19.5 0.6	-23.1 0.1	-26.8 -0.5	-30.5 -1.2	-34.4 -1.7	-38.4 -2.3	-42.4 -2.8	-46.5 -3.3	-50.7 -3.7	-54.9 -4.0	-59.2 -4.3	-63.6 -4.5	-75
-80	-20.8 0.3	-24.8 0.0	-28.8 -0.3	-32.9 -0.6	-37.1 -1.0	-41.3 -1.3	-45.6 -1.6	-49.9 -1.8	-54.3 -2.1	-58.8 -2.3	-63.3 -2.6	-68.0 -2.7	-80
-85	-23.3 -0.1	-27.7 -0.2	-32.2 -0.3	-36.7 -0.4	-41.2 -0.6	-45.8 -0.7	-50.4 -0.8	-55.0 -0.9	-59.7 -1.0	-64.5 -1.1	-69.3 -1.2	-74.1 -1.3	-85
-90	-27.5 -0.5	-32.5 -0.5	-37.5 -0.5	-42.5 -0.5	-47.5 -0.5	-52.5 -0.5	-57.5 -0.5	-62.5 -0.5	-67.5 -0.5	-72.5 -0.5	-77.5 -0.5	-82.5 -0.5	-90
Lat													Lat
E. Long	0	5	10	15	20	25	30	35	40	45	50	55	E. Long

DECLINATION (D) WMM-95

E. Long	60	65	70	75	80	85	90	95	100	105	110	115	E. Long
Lat 0	-4.2 -1.8	-4.8 -1.5	-5.0 -0.5	-4.8 1.0	-4.3 2.6	-3.6 3.9	-2.6 4.6	-1.6 4.3	-0.7 3.3	0.1 1.8	0.6 0.2	0.9 -1.0	Lat 0
-5	-6.3 -2.5	-6.9 -1.9	-6.9 -0.7	-6.6 1.1	-5.9 2.9	-4.9 4.3	-3.7 4.9	-2.4 4.6	-1.1 3.5	-0.1 2.0	0.7 0.4	1.2 -0.8	-5
-10	-9.2 -3.4	-9.7 -2.4	-9.6 -0.8	-9.1 1.2	-8.1 3.1	-6.8 4.6	-5.2 5.3	-3.5 5.0	-1.9 3.9	-0.6 2.4	0.5 0.9	1.2 -0.3	-10
-15	-13.2 -4.3	-13.5 -2.9	-13.3 -1.0	-12.4 1.2	-11.1 3.3	-9.4 4.8	-7.4 5.5	-5.3 5.3	-3.3 4.3	-1.5 2.9	-0.1 1.5	1.0 0.4	-15
-20	-18.4 -5.2	-18.5 -3.5	-18.0 -1.3	-16.8 1.0	-15.1 3.2	-13.0 4.8	-10.5 5.7	-7.8 5.6	-5.2 4.7	-2.9 3.5	-1.1 2.2	0.4 1.2	-20
-25	-24.7 -5.9	-24.6 -4.1	-23.7 -1.9	-22.3 0.4	-20.2 2.6	-17.6 4.4	-14.6 5.4	-11.3 5.6	-8.1 5.0	-5.2 4.0	-2.6 2.9	-0.6 2.0	-25
-30	-31.5 -6.6	-31.2 -4.9	-30.3 -2.9	-28.6 -0.7	-26.3 1.5	-23.4 3.3	-19.9 4.6	-16.1 5.1	-12.1 5.0	-8.4 4.3	-5.1 3.5	-2.2 2.7	-30
-35	-37.9 -7.3	-37.8 -5.9	-37.0 -4.2	-35.5 -2.4	-33.3 -0.4	-30.3 1.4	-26.6 2.9	-22.3 3.9	-17.6 4.3	-13.0 4.2	-8.7 3.8	-4.8 3.3	-35
-40	-43.6 -8.1	-43.9 -7.0	-43.6 -5.8	-42.6 -4.4	-40.8 -2.8	-38.1 -1.3	-34.6 0.3	-30.1 1.6	-25.0 2.6	-19.5 3.2	-14.0 3.4	-8.8 3.4	-40
-45	-48.3 -9.0	-49.3 -8.2	-49.6 -7.3	-49.3 -6.4	-48.3 -5.3	-46.4 -4.2	-43.6 -3.0	-39.6 -1.7	-34.5 -0.4	-28.5 0.9	-21.9 1.9	-15.2 2.7	-45
-50	-52.3 -9.6	-53.9 -9.1	-55.0 -8.6	-55.7 -8.0	-55.7 -7.4	-54.9 -6.8	-53.3 -6.1	-50.5 -5.3	-46.5 -4.3	-40.9 -3.1	-33.9 -1.5	-25.7 0.2	-50
-55	-55.6 -9.8	-57.9 -9.5	-59.9 -9.2	-61.5 -8.9	-62.6 -8.7	-63.2 -8.5	-63.1 -8.4	-62.2 -8.3	-60.2 -8.1	-56.7 -7.8	-51.3 -7.1	-43.4 -5.7	-55
-60	-58.6 -9.3	-61.6 -9.2	-64.3 -9.1	-66.8 -9.0	-69.1 -9.0	-71.0 -9.1	-72.6 -9.3	-73.8 -9.6	-74.4 -10.1	-74.2 -10.8	-72.8 -11.8	-69.5 -13.0	-60
-65	-61.4 -8.2	-65.0 -8.2	-68.4 -8.2	-71.8 -8.3	-75.0 -8.3	-78.2 -8.5	-81.3 -8.7	-84.3 -9.1	-87.2 -9.7	-90.1 -10.5	-92.9 -11.7	-95.8 -13.5	-65
-70	-64.4 -6.6	-68.4 -6.7	-72.5 -6.8	-76.5 -6.9	-80.6 -7.0	-84.8 -7.1	-89.0 -7.3	-93.3 -7.5	-97.8 -7.8	-102.6 -8.2	-107.9 -8.7	-113.7 -9.4	-70
-75	-68.0 -4.7	-72.4 -4.9	-76.9 -5.0	-81.5 -5.1	-86.2 -5.2	-91.0 -5.3	-95.9 -5.4	-101.1 -5.5	-106.4 -5.5	-112.1 -5.6	-118.1 -5.7	-124.6 -5.7	-75
-80	-72.6 -2.9	-77.4 -3.0	-82.3 -3.2	-87.2 -3.2	-92.2 -3.3	-97.4 -3.4	-102.7 -3.4	-108.2 -3.4	-113.8 -3.4	-119.6 -3.4	-125.6 -3.4	-131.9 -3.3	-80
-85	-79.0 -1.4	-84.0 -1.5	-89.0 -1.6	-94.1 -1.6	-99.3 -1.6	-104.5 -1.7	-109.8 -1.7	-115.2 -1.7	-120.7 -1.7	-126.2 -1.7	-131.8 -1.7	-137.5 -1.6	-85
-90	-87.5 -0.5	-92.5 -0.5	-97.5 -0.5	-102.5 -0.5	-107.5 -0.5	-112.5 -0.5	-117.5 -0.5	-122.5 -0.5	-127.5 -0.5	-132.5 -0.5	-137.5 -0.5	-142.5 -0.5	-90
Lat													Lat
E. Long	60	65	70	75	80	85	90	95	100	105	110	115	E. Long

DECLINATION (D) WMM-95

E. Long	120	125	130	135	140	145	150	155	160	165	170	175	E. Long
Lat 0	1.1 -1.6	1.4 -1.6	1.9 -1.0	2.7 -0.2	3.7 0.5	4.7 0.8	5.9 0.6	7.0 0.0	8.2 -0.9	9.1 -1.9	9.9 -2.7	10.3 -3.4	Lat 0
-5	1.5 -1.3	2.0 -1.3	2.6 -0.8	3.4 0.0	4.4 0.6	5.5 0.8	6.6 0.6	7.7 0.0	8.8 -0.8	9.7 -1.7	10.3 -2.5	10.7 -3.1	-5
-10	1.8 -0.8	2.4 -0.9	3.1 -0.4	4.0 0.1	5.1 0.5	6.2 0.7	7.3 0.4	8.4 -0.1	9.4 -0.8	10.3 -1.6	10.9 -2.3	11.3 -2.8	-10
-15	1.8 -0.2	2.7 -0.3	3.5 -0.1	4.6 0.2	5.7 0.4	6.8 0.4	8.0 0.1	9.1 -0.4	10.1 -1.0	11.0 -1.5	11.7 -2.0	12.1 -2.4	-15
-20	1.6 0.6	2.7 0.3	3.8 0.3	5.0 0.4	6.3 0.3	7.6 0.1	8.8 -0.2	10.0 -0.6	11.1 -1.1	12.0 -1.4	12.7 -1.7	13.2 -2.0	-20
-25	1.1 1.4	2.6 1.0	4.0 0.8	5.5 0.6	6.9 0.3	8.4 -0.1	9.8 -0.4	11.1 -0.8	12.3 -1.0	13.3 -1.2	14.0 -1.3	14.6 -1.4	-25
-30	0.1 2.1	2.2 1.7	4.1 1.3	5.9 0.8	7.7 0.4	9.4 -0.1	11.0 -0.4	12.5 -0.7	13.8 -0.8	14.9 -0.8	15.7 -0.7	16.3 -0.7	-30
-35	-1.5 2.8	1.4 2.3	4.0 1.8	6.3 1.3	8.6 0.7	10.7 0.2	12.6 -0.2	14.3 -0.3	15.7 -0.3	16.9 -0.2	17.8 0.0	18.5 0.1	-35
-40	-4.2 3.2	-0.1 2.8	3.5 2.4	6.7 1.8	9.6 1.3	12.2 0.8	14.5 0.5	16.5 0.4	18.2 0.5	19.5 0.7	20.4 0.9	21.1 1.0	-40
-45	-8.8 3.1	-2.9 3.2	2.3 3.0	6.9 2.6	10.9 2.1	14.3 1.7	17.1 1.5	19.5 1.5	21.3 1.6	22.7 1.7	23.7 1.9	24.4 1.9	-45
-50	-17.0 1.8	-8.3 2.9	-0.3 3.5	6.6 3.6	12.3 3.4	17.0 3.2	20.7 3.0	23.5 3.0	25.6 3.0	27.1 3.0	28.1 3.0	28.7 3.0	-50
-55	-32.8 -3.2	-20.2 0.2	-7.0 3.3	4.9 5.1	14.3 5.8	21.2 5.8	26.2 5.5	29.7 5.2	32.0 5.0	33.5 4.7	34.4 4.5	34.9 4.3	-55
-60	-63.0 -14.1	-50.9 -13.4	-30.1 -6.3	-3.5 6.6	17.9 12.7	30.5 12.5	37.5 10.9	41.3 9.4	43.3 8.2	44.3 7.3	44.7 6.6	44.6 6.0	-60
-65	-98.6 -16.4	-101.8 -21.4	-105.6 -32.2	-112.9 -69.2	107.1 188.3	78.0 45.4	73.1 24.9	70.1 17.1	67.5 13.1	65.3 10.6	63.3 9.0	61.4 7.9	-65
-70	-120.5 -10.1	-128.6 -10.9	-138.9 -11.5	-152.6 -11.2	-170.7 -8.3	167.3 -2.0	145.0 4.7	126.6 8.3	112.9 9.2	102.7 8.8	95.0 8.0	89.0 7.2	-70
-75	-131.7 -5.7	-139.5 -5.6	-148.0 -5.4	-157.4 -4.9	-167.7 -4.1	-178.7 -3.0	169.8 -1.8	158.3 -0.5	147.3 0.7	137.1 1.6	127.8 2.3	119.6 2.6	-75
-80	-138.4 -3.2	-145.1 -3.1	-152.1 -2.9	-159.4 -2.7	-166.8 -2.4	-174.5 -2.1	177.8 -1.7	170.0 -1.4	162.3 -1.0	154.7 -0.7	147.2 -0.4	140.1 -0.2	-80
-85	-143.2 -1.6	-149.0 -1.5	-154.9 -1.5	-160.8 -1.4	-166.8 -1.3	-172.8 -1.3	-178.8 -1.2	175.1 -1.1	169.1 -1.0	163.1 -0.9	157.2 -0.8	151.3 -0.7	-85
-90	-147.5 -0.5	-152.5 -0.5	-157.5 -0.5	-162.5 -0.5	-167.5 -0.5	-172.5 -0.5	-177.5 -0.5	177.5 -0.5	172.5 -0.5	167.5 -0.5	162.5 -0.5	157.5 -0.5	-90
Lat													Lat
E. Long	120	125	130	135	140	145	150	155	160	165	170	175	E. Long

DECLINATION (D) WMM-95

E. Long	180	185	190	195	200	205	210	215	220	225	230	235	E. Long
Lat 0	10.4 -3.8	10.2 -4.0	9.8 -3.9	9.5 -3.4	9.2 -2.6	9.1 -1.4	9.1 -0.1	9.1 1.1	9.1 2.1	9.1 2.7	9.1 2.8	9.1 2.4	Lat 0
-5	10.8 -3.6	10.6 -3.8	10.3 -3.7	9.9 -3.2	9.7 -2.4	9.6 -1.2	9.6 0.2	9.6 1.5	9.7 2.5	9.6 3.1	9.6 3.0	9.6 2.5	-5
-10	11.4 -3.2	11.2 -3.4	11.0 -3.3	10.7 -2.9	10.5 -2.1	10.5 -1.0	10.5 0.4	10.5 1.8	10.5 2.8	10.5 3.3	10.4 3.2	10.4 2.6	-10
-15	12.2 -2.7	12.1 -2.9	12.0 -2.9	11.8 -2.5	11.7 -1.8	11.6 -0.7	11.7 0.7	11.7 1.9	11.7 2.9	11.7 3.4	11.6 3.3	11.5 2.6	-15
-20	13.4 -2.2	13.4 -2.3	13.3 -2.3	13.2 -2.0	13.1 -1.3	13.1 -0.3	13.1 0.9	13.2 2.1	13.2 3.0	13.1 3.4	13.0 3.3	12.9 2.7	-20
-25	14.8 -1.5	14.9 -1.6	14.9 -1.6	14.8 -1.3	14.8 -0.8	14.7 0.0	14.8 1.1	14.8 2.1	14.8 3.0	14.8 3.4	14.7 3.3	14.6 2.8	-25
-30	16.6 -0.7	16.8 -0.8	16.8 -0.8	16.7 -0.6	16.7 -0.2	16.7 0.5	16.7 1.4	16.7 2.3	16.7 3.0	16.7 3.4	16.7 3.4	16.7 3.0	-30
-35	18.8 0.1	19.0 0.0	19.0 0.0	19.0 0.1	18.9 0.4	18.8 1.0	18.8 1.7	18.8 2.5	18.9 3.2	18.9 3.6	19.0 3.6	19.2 3.4	-35
-40	21.5 1.0	21.7 0.9	21.7 0.8	21.6 0.9	21.5 1.1	21.4 1.6	21.4 2.2	21.4 2.9	21.5 3.5	21.7 3.9	21.9 4.0	22.1 3.8	-40
-45	24.8 1.9	24.9 1.8	24.9 1.7	24.8 1.8	24.7 2.0	24.6 2.4	24.6 2.9	24.7 3.5	24.8 4.0	25.0 4.3	25.3 4.4	25.6 4.1	-45
-50	29.0 2.9	29.1 2.7	29.1 2.7	28.9 2.7	28.8 2.9	28.7 3.2	28.7 3.7	28.8 4.1	29.0 4.5	29.2 4.6	29.4 4.6	29.6 4.3	-50
-55	35.0 4.0	35.0 3.9	34.8 3.8	34.6 3.8	34.4 3.9	34.2 4.1	34.2 4.4	34.2 4.6	34.2 4.8	34.3 4.7	34.3 4.5	34.2 4.0	-55
-60	44.3 5.5	43.8 5.2	43.3 5.0	42.8 4.9	42.3 4.8	41.9 4.8	41.6 4.8	41.2 4.8	40.9 4.7	40.6 4.4	40.2 3.9	39.7 3.3	-60
-65	59.6 7.0	58.0 6.4	56.5 5.9	55.2 5.6	53.9 5.3	52.8 5.0	51.7 4.7	50.7 4.4	49.7 4.0	48.6 3.5	47.4 3.0	46.2 2.3	-65
-70	84.0 6.5	79.8 5.9	76.2 5.4	73.1 4.9	70.3 4.5	67.7 4.0	65.3 3.6	63.0 3.2	60.8 2.7	58.6 2.3	56.5 1.8	54.2 1.3	-70
-75	112.3 2.8	105.8 2.8	100.0 2.7	94.8 2.5	90.1 2.3	85.7 2.1	81.7 1.8	77.9 1.5	74.3 1.3	70.8 1.0	67.4 0.7	64.1 0.4	-75
-80	133.2 0.0	126.6 0.2	120.4 0.3	114.4 0.3	108.8 0.4	103.4 0.3	98.3 0.3	93.4 0.3	88.7 0.2	84.1 0.1	79.7 0.1	75.4 0.0	-80
-85	145.5 -0.6	139.7 -0.6	134.0 -0.5	128.4 -0.4	123.0 -0.4	117.6 -0.4	112.2 -0.3	107.0 -0.3	101.9 -0.2	96.9 -0.2	91.9 -0.2	87.0 -0.2	-85
-90	152.5 -0.5	147.5 -0.5	142.5 -0.5	137.5 -0.5	132.5 -0.5	127.5 -0.5	122.5 -0.5	117.5 -0.5	112.5 -0.5	107.5 -0.5	102.5 -0.5	97.5 -0.5	-90
Lat													Lat
E. Long	180	185	190	195	200	205	210	215	220	225	230	235	E. Long

DECLINATION (D) WMM-95

E. Long	240	245	250	255	260	265	270	275	280	285	290	295	E. Long
Lat 0	9.2 1.7	9.2 0.9	9.2 0.1	8.9 -0.7	8.4 -1.5	7.3 -2.7	5.7 -4.1	3.4 -6.0	0.6 -8.0	-2.7 -9.9	-6.3 -11.1	-9.9 -11.2	Lat 0
-5	9.6 1.7	9.6 0.8	9.6 0.0	9.4 -0.7	9.0 -1.5	8.1 -2.4	6.6 -3.7	4.5 -5.4	1.6 -7.4	-1.7 -9.4	-5.4 -10.9	-9.1 -11.5	-5
-10	10.3 1.7	10.3 0.7	10.3 -0.1	10.2 -0.8	9.8 -1.4	9.0 -2.1	7.6 -3.2	5.6 -4.8	2.8 -6.7	-0.5 -8.8	-4.3 -10.5	-8.2 -11.5	-10
-15	11.4 1.7	11.4 0.7	11.3 -0.1	11.2 -0.7	10.8 -1.3	10.1 -1.9	8.9 -2.9	6.9 -4.3	4.2 -6.1	0.9 -8.1	-3.0 -9.9	-7.1 -11.1	-15
-20	12.8 1.8	12.7 0.9	12.7 0.0	12.5 -0.6	12.2 -1.1	11.6 -1.7	10.4 -2.6	8.5 -3.9	5.9 -5.6	2.5 -7.5	-1.4 -9.2	-5.6 -10.5	-20
-25	14.5 2.0	14.5 1.1	14.5 0.3	14.3 -0.3	14.1 -0.9	13.4 -1.6	12.3 -2.5	10.5 -3.7	7.9 -5.2	4.5 -6.9	0.5 -8.5	-3.8 -9.6	-25
-30	16.7 2.3	16.7 1.6	16.7 0.8	16.6 0.0	16.3 -0.7	15.7 -1.5	14.5 -2.4	12.7 -3.6	10.1 -5.0	6.8 -6.4	2.8 -7.7	-1.7 -8.6	-30
-35	19.3 2.8	19.4 2.1	19.4 1.3	19.3 0.5	19.0 -0.4	18.2 -1.3	17.0 -2.4	15.1 -3.5	12.5 -4.8	9.2 -6.0	5.2 -7.0	0.8 -7.6	-35
-40	22.3 3.3	22.5 2.6	22.5 1.7	22.3 0.8	21.8 -0.2	21.0 -1.2	19.6 -2.3	17.6 -3.5	14.9 -4.5	11.6 -5.5	7.8 -6.1	3.5 -6.4	-40
-45	25.8 3.6	25.9 2.9	25.8 2.0	25.5 1.0	24.8 -0.1	23.7 -1.2	22.1 -2.3	19.9 -3.3	17.2 -4.2	14.0 -4.9	10.3 -5.2	6.3 -5.1	-45
-50	29.7 3.7	29.6 2.9	29.3 1.9	28.7 0.9	27.7 -0.2	26.3 -1.3	24.4 -2.2	22.1 -3.1	19.4 -3.7	16.2 -4.1	12.7 -4.2	9.0 -3.8	-50
-55	34.0 3.3	33.6 2.5	32.9 1.5	31.9 0.6	30.5 -0.4	28.8 -1.3	26.8 -2.1	24.3 -2.8	21.5 -3.1	18.5 -3.3	15.1 -3.1	11.7 -2.6	-55
-60	38.9 2.6	38.0 1.8	36.8 1.0	35.4 0.1	33.6 -0.7	31.6 -1.4	29.2 -1.9	26.7 -2.3	23.8 -2.5	20.8 -2.4	17.6 -2.0	14.4 -1.4	-60
-65	44.8 1.7	43.2 1.0	41.4 0.3	39.4 -0.3	37.2 -0.8	34.8 -1.3	32.2 -1.6	29.4 -1.7	26.5 -1.7	23.5 -1.5	20.4 -1.1	17.2 -0.5	-65
-70	51.9 0.8	49.6 0.3	47.1 -0.1	44.5 -0.5	41.8 -0.8	38.9 -1.0	36.0 -1.1	33.0 -1.1	29.9 -0.9	26.8 -0.7	23.6 -0.3	20.4 0.2	-70
-75	60.8 0.2	57.5 -0.1	54.2 -0.3	51.0 -0.4	47.7 -0.5	44.3 -0.5	41.0 -0.5	37.6 -0.4	34.2 -0.2	30.8 0.0	27.5 0.2	24.1 0.6	-75
-80	71.2 -0.1	67.1 -0.1	63.0 -0.1	59.0 -0.1	55.1 -0.1	51.1 -0.1	47.3 0.0	43.4 0.1	39.6 0.2	35.8 0.3	32.0 0.5	28.2 0.6	-80
-85	82.2 -0.1	77.5 -0.1	72.8 -0.1	68.2 0.0	63.6 0.0	59.1 0.0	54.6 0.1	50.2 0.1	45.8 0.1	41.4 0.2	37.1 0.2	32.7 0.3	-85
-90 Lat	92.5 -0.5	87.5 -0.5	82.5 -0.5	77.5 -0.5	72.5 -0.5	67.5 -0.5	62.5 -0.5	57.5 -0.5	52.5 -0.5	47.5 -0.5	42.5 -0.5	37.5 -0.5	-90 Lat
E. Long	240	245	250	255	260	265	270	275	280	285	290	295	E. Long

DECLINATION (D) WMM-95

E. Long	300	305	310	315	320	325	330	335	340	345	350	355	E. Long
Lat													Lat
0	-13.2 -10.1	-16.1 -8.1	-18.4 -5.5	-20.0 -2.7	-20.8 0.0	-20.8 2.3	-19.9 4.3	-18.4 5.8	-16.4 7.0	-14.2 7.7	-12.0 7.9	-9.9 7.6	0
-5	-12.6 -11.0	-15.8 -9.4	-18.4 -7.1	-20.4 -4.4	-21.6 -1.7	-22.0 0.7	-21.5 2.9	-20.3 4.8	-18.6 6.3	-16.6 7.4	-14.5 7.9	-12.4 7.9	-5
-10	-12.0 -11.4	-15.4 -10.3	-18.3 -8.4	-20.7 -6.0	-22.2 -3.5	-23.0 -1.0	-23.0 1.3	-22.2 3.3	-20.9 5.1	-19.2 6.5	-17.4 7.5	-15.4 8.0	-10
-15	-11.1 -11.4	-14.8 -10.7	-18.0 -9.2	-20.6 -7.2	-22.5 -4.9	-23.7 -2.6	-24.1 -0.4	-23.8 1.6	-23.0 3.5	-21.8 5.2	-20.4 6.6	-18.7 7.6	-15
-20	-9.9 -11.0	-13.9 -10.6	-17.4 -9.5	-20.3 -7.8	-22.5 -5.9	-24.0 -3.9	-24.8 -1.9	-25.0 0.0	-24.7 1.8	-24.0 3.6	-23.0 5.2	-21.7 6.6	-20
-25	-8.3 -10.2	-12.5 -10.0	-16.3 -9.1	-19.5 -7.7	-22.0 -6.1	-23.7 -4.4	-24.9 -2.7	-25.5 -1.0	-25.6 0.6	-25.4 2.2	-24.9 3.7	-24.1 5.1	-25
-30	-6.3 -9.0	-10.7 -8.8	-14.7 -8.0	-18.1 -6.8	-20.9 -5.4	-22.9 -3.9	-24.3 -2.5	-25.2 -1.1	-25.7 0.3	-25.9 1.6	-25.8 2.9	-25.4 4.0	-30
-35	-3.8 -7.7	-8.3 -7.3	-12.5 -6.4	-16.1 -5.2	-19.0 -3.9	-21.3 -2.5	-22.9 -1.1	-24.1 0.1	-24.8 1.2	-25.3 2.2	-25.5 3.0	-25.4 3.6	-35
-40	-1.0 -6.2	-5.4 -5.5	-9.5 -4.4	-13.2 -3.1	-16.2 -1.7	-18.7 -0.2	-20.5 1.1	-21.9 2.3	-22.9 3.3	-23.5 3.9	-24.0 4.1	-24.3 3.9	-40
-45	2.1 -4.6	-2.1 -3.7	-6.0 -2.4	-9.6 -0.9	-12.6 0.7	-15.2 2.3	-17.2 3.7	-18.8 4.8	-20.0 5.5	-20.9 5.7	-21.7 5.4	-22.4 4.4	-45
-50	5.2 -3.1	1.3 -2.0	-2.3 -0.6	-5.6 1.0	-8.6 2.6	-11.1 4.2	-13.3 5.5	-15.0 6.5	-16.5 6.9	-17.9 6.8	-19.1 6.0	-20.3 4.5	-50
-55	8.2 -1.7	4.7 -0.6	1.4 0.8	-1.8 2.3	-4.6 3.8	-7.1 5.1	-9.4 6.2	-11.4 6.9	-13.2 7.1	-14.9 6.7	-16.6 5.6	-18.4 4.0	-55
-60	11.1 -0.6	7.9 0.4	4.8 1.6	1.8 2.8	-1.0 4.0	-3.6 5.1	-6.0 5.9	-8.2 6.3	-10.4 6.2	-12.5 5.7	-14.7 4.7	-16.9 3.3	-60
-65	14.1 0.2	11.0 1.0	8.0 1.9	5.0 2.9	2.2 3.7	-0.5 4.4	-3.2 4.9	-5.7 5.0	-8.2 4.9	-10.8 4.4	-13.3 3.6	-16.0 2.5	-65
-70	17.3 0.7	14.1 1.3	11.0 1.9	8.0 2.5	5.0 3.0	2.0 3.4	-0.9 3.6	-3.8 3.7	-6.7 3.5	-9.6 3.1	-12.6 2.5	-15.7 1.8	-70
-75	20.7 0.9	17.3 1.2	14.0 1.6	10.7 1.9	7.4 2.1	4.1 2.3	0.8 2.4	-2.4 2.3	-5.7 2.2	-9.1 2.0	-12.5 1.6	-15.9 1.1	-75
-80	24.4 0.8	20.7 0.9	17.0 1.0	13.2 1.1	9.5 1.2	5.8 1.3	2.1 1.3	-1.7 1.2	-5.4 1.1	-9.2 1.0	-13.1 0.8	-16.9 0.5	-80
-85	28.4 0.3	24.1 0.3	19.8 0.3	15.5 0.4	11.3 0.4	7.0 0.3	2.7 0.3	-1.6 0.3	-5.9 0.2	-10.2 0.2	-14.6 0.1	-18.9 0.0	-85
-90	32.5 -0.5	27.5 -0.5	22.5 -0.5	17.5 -0.5	12.5 -0.5	7.5 -0.5	2.5 -0.5	-2.5 -0.5	-7.5 -0.5	-12.5 -0.5	-17.5 -0.5	-22.5 -0.5	-90
Lat													Lat
E. Long	300	305	310	315	320	325	330	335	340	345	350	355	E. Long

INCLINATION (I) WMM-95

E. Long	0	5	10	15	20	25	30	35	40	45	50	55	E. Long
Lat 90	87.8 0.5	87.8 0.5	87.8 0.5	87.8 0.5	87.8 0.5	87.8 0.5	87.8 0.5	87.8 0.5	87.8 0.5	87.8 0.5	87.8 0.5	87.8 0.5	Lat 90
85	85.3 0.5	85.3 0.5	85.3 0.5	85.3 0.5	85.3 0.5	85.4 0.5	85.5 0.5	85.6 0.5	85.7 0.5	85.8 0.5	85.9 0.5	86.1 0.5	85
80	82.8 0.6	82.8 0.6	82.8 0.6	82.8 0.6	82.9 0.6	83.0 0.7	83.1 0.7	83.3 0.7	83.5 0.7	83.7 0.7	84.0 0.7	84.2 0.7	80
75	80.4 0.5	80.4 0.6	80.4 0.6	80.4 0.7	80.5 0.7	80.7 0.7	80.8 0.7	81.0 0.8	81.3 0.8	81.5 0.8	81.9 0.8	82.2 0.8	75
70	78.0 0.4	78.0 0.5	78.0 0.6	78.0 0.6	78.1 0.7	78.3 0.7	78.5 0.7	78.7 0.8	78.9 0.8	79.2 0.8	79.6 0.8	80.0 0.8	70
65	75.4 0.3	75.4 0.4	75.4 0.5	75.5 0.6	75.6 0.6	75.8 0.7	75.9 0.7	76.2 0.7	76.4 0.7	76.7 0.7	77.1 0.8	77.5 0.8	65
60	72.5 0.1	72.5 0.3	72.6 0.4	72.7 0.5	72.8 0.6	73.0 0.7	73.2 0.7	73.4 0.7	73.7 0.6	74.0 0.6	74.3 0.6	74.6 0.6	60
55	69.1 0.0	69.2 0.2	69.3 0.4	69.5 0.6	69.7 0.6	69.9 0.7	70.1 0.6	70.3 0.6	70.5 0.5	70.8 0.5	71.1 0.5	71.4 0.5	55
50	65.2 -0.2	65.4 0.2	65.5 0.5	65.8 0.6	66.0 0.7	66.2 0.7	66.5 0.6	66.7 0.6	67.0 0.5	67.2 0.4	67.5 0.3	67.7 0.3	50
45	60.6 -0.4	60.8 0.1	61.0 0.5	61.3 0.7	61.6 0.8	61.9 0.7	62.2 0.6	62.5 0.5	62.8 0.4	63.0 0.3	63.3 0.3	63.5 0.2	45
40	55.1 -0.6	55.3 0.0	55.6 0.5	56.0 0.8	56.3 0.8	56.7 0.7	57.0 0.6	57.4 0.4	57.8 0.4	58.1 0.3	58.4 0.3	58.6 0.2	40
35	48.5 -0.9	48.8 0.0	49.2 0.5	49.6 0.7	50.0 0.7	50.4 0.6	50.8 0.4	51.3 0.3	51.8 0.3	52.2 0.4	52.5 0.4	52.7 0.4	35
30	40.6 -1.2	41.0 -0.2	41.4 0.4	41.9 0.6	42.3 0.5	42.8 0.3	43.4 0.1	44.0 0.1	44.6 0.2	45.2 0.4	45.6 0.6	45.8 0.6	30
25	31.4 -1.5	31.8 -0.4	32.2 0.1	32.8 0.3	33.3 0.1	33.8 -0.2	34.5 -0.3	35.3 -0.2	36.1 0.1	36.9 0.5	37.4 0.9	37.7 1.0	25
2	20.8 -2.0	21.1 -0.9	21.6 -0.3	22.2 -0.2	22.7 -0.5	23.4 -0.8	24.2 -0.8	25.2 -0.6	26.2 0.0	27.2 0.7	27.9 1.2	28.3 1.3	20
15	9.0 -2.7	9.3 -1.5	9.7 -0.9	10.3 -0.9	10.9 -1.2	11.6 -1.4	12.6 -1.4	13.8 -0.8	15.1 0.0	16.3 0.9	17.1 1.5	17.5 1.6	15
10	-3.6 -3.5	-3.4 -2.3	-3.0 -1.7	-2.5 -1.7	-1.9 -1.9	-1.1 -2.0	0.0 -1.8	1.4 -1.0	2.9 0.0	4.3 1.1	5.3 1.8	5.8 1.8	10
5	-16.1 -4.5	-16.1 -3.2	-15.8 -2.6	-15.4 -2.5	-14.8 -2.5	-14.0 -2.4	-12.8 -2.0	-11.2 -1.0	-9.6 0.2	-8.1 1.3	-7.0 1.9	-6.5 1.8	5
0 Lat	-27.8 -5.5	-28.1 -4.2	-28.0 -3.5	-27.8 -3.2	-27.2 -3.0	-26.3 -2.6	-25.1 -1.9	-23.5 -0.9	-21.8 0.3	-20.2 1.4	-19.1 1.9	-18.5 1.6	0 Lat
E. Long	0	5	10	15	20	25	30	35	40	45	50	55	E. Long

E. Long	60	65	70	75	80	85	90	95	100	105	110	115	E. Long
Lat 90	87.8 0.5	87.8 0.5	87.8 0.5	87.8 0.5	87.8 0.5	87.8 0.5	87.8 0.5	87.8 0.5	87.8 0.5	87.8 0.5	87.8 0.5	87.8 0.5	Lat 90
85	86.3 0.5	86.4 0.5	86.6 0.5	86.8 0.6	87.0 0.6	87.2 0.6	87.4 0.6	87.6 0.6	87.8 0.7	88.0 0.7	88.2 0.8	88.3 0.8	85
80	84.5 0.7	84.9 0.7	85.2 0.7	85.6 0.7	86.0 0.7	86.3 0.7	86.7 0.8	87.0 0.8	87.3 0.9	87.5 0.9	87.6 1.0	87.6 1.1	80
75	82.6 0.8	83.1 0.8	83.5 0.8	84.0 0.9	84.5 0.9	84.9 0.9	85.4 0.9	85.7 1.0	86.0 1.0	86.1 1.1	86.0 1.2	85.8 1.2	75
70	80.4 0.9	80.9 0.9	81.4 0.9	81.9 0.9	82.5 1.0	83.0 1.0	83.4 1.1	83.7 1.1	83.9 1.2	83.9 1.3	83.8 1.4	83.4 1.5	70
65	77.9 0.8	78.4 0.8	78.9 0.9	79.4 0.9	79.9 1.0	80.4 1.1	80.8 1.1	81.1 1.3	81.2 1.4	81.1 1.5	80.9 1.6	80.4 1.7	65
60	75.0 0.7	75.5 0.7	75.9 0.7	76.4 0.8	76.8 0.9	77.2 1.0	77.6 1.1	77.8 1.3	77.9 1.5	77.8 1.7	77.5 1.9	77.0 2.0	60
55	71.7 0.5	72.1 0.5	72.4 0.5	72.8 0.6	73.2 0.7	73.5 0.8	73.8 1.0	74.0 1.3	74.0 1.6	73.9 1.8	73.6 2.1	73.1 2.3	55
50	68.0 0.3	68.2 0.3	68.5 0.3	68.8 0.3	69.0 0.4	69.3 0.7	69.5 0.9	69.6 1.3	69.6 1.6	69.5 2.0	69.2 2.4	68.7 2.6	50
45	63.7 0.2	63.8 0.1	64.0 0.0	64.1 0.1	64.3 0.2	64.4 0.5	64.6 0.8	64.7 1.3	64.7 1.8	64.6 2.2	64.3 2.6	63.8 2.9	45
40	58.7 0.1	58.7 0.0	58.8 -0.1	58.8 -0.1	58.9 0.0	58.9 0.3	59.0 0.8	59.1 1.3	59.1 1.9	59.0 2.5	58.7 3.0	58.3 3.3	40
35	52.8 0.2	52.8 0.0	52.7 -0.2	52.6 -0.3	52.6 -0.2	52.5 0.2	52.6 0.8	52.6 1.5	52.6 2.3	52.5 2.9	52.3 3.4	52.0 3.6	35
30	45.9 0.5	45.8 0.1	45.6 -0.2	45.4 -0.4	45.3 -0.3	45.1 0.1	45.1 0.9	45.1 1.8	45.1 2.7	45.1 3.4	45.0 3.9	44.7 4.0	30
25	37.7 0.7	37.6 0.2	37.3 -0.3	37.0 -0.6	36.7 -0.5	36.5 0.1	36.4 1.1	36.4 2.2	36.4 3.3	36.5 4.1	36.5 4.5	36.3 4.5	25
20	28.3 1.0	28.0 0.4	27.7 -0.3	27.3 -0.7	26.9 -0.6	26.6 0.1	26.5 1.3	26.4 2.7	26.5 4.0	26.7 4.9	26.8 5.1	26.7 4.9	20
15	17.5 1.2	17.2 0.4	16.8 -0.5	16.3 -1.0	15.9 -0.8	15.5 0.1	15.3 1.6	15.3 3.2	15.5 4.7	15.7 5.5	16.0 5.7	16.1 5.2	15
10	5.8 1.2	5.4 0.2	4.9 -0.7	4.4 -1.2	3.9 -1.0	3.5 0.1	3.3 1.7	3.3 3.6	3.6 5.1	4.0 6.0	4.4 6.0	4.7 5.3	10
5	-6.5 1.1	-6.8 0.0	-7.3 -1.0	-7.9 -1.5	-8.4 -1.2	-8.7 0.0	-8.9 1.7	-8.8 3.6	-8.5 5.2	-7.9 6.0	-7.4 5.9	-6.9 5.1	5
0	-18.4 0.8	-18.8 -0.4	-19.3 -1.4	-19.8 -1.8	-20.2 -1.4	-20.6 -0.2	-20.7 1.5	-20.5 3.3	-20.1 4.8	-19.5 5.6	-18.8 5.5	-18.2 4.6	0
Lat													Lat
E. Long	60	65	70	75	80	85	90	95	100	105	110	115	E. Long

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E. Long Lat	120	125	130	135	140	145	150	155	160	165	170	175	E. Long Lat
90	87.8 0.5	87.8 0.5	87.8 0.5	87.8 0.5	87.8 0.5	87.8 0.5	87.8 0.5	87.8 0.5	87.8 0.5	87.8 0.5	87.8 0.5	87.8 0.5	90
85	88.4 0.9	88.5 1.0	88.6 1.0	88.6 1.1	88.6 1.1	88.6 1.2	88.6 1.2	88.5 1.2	88.5 1.2	88.5 1.2	88.5 1.2	88.5 1.2	85
80	87.5 1.1	87.3 1.1	87.1 1.2	86.9 1.2	86.6 1.2	86.4 1.2	86.1 1.3	85.9 1.3	85.8 1.3	85.6 1.3	85.5 1.3	85.5 1.3	80
75	85.5 1.3	85.1 1.3	84.7 1.4	84.2 1.5	83.8 1.5	83.3 1.6	82.9 1.6	82.6 1.7	82.3 1.7	82.1 1.8	82.0 1.8	81.9 1.8	75
70	82.9 1.6	82.4 1.6	81.7 1.7	81.1 1.8	80.5 1.9	79.9 2.0	79.4 2.1	78.9 2.2	78.6 2.2	78.3 2.2	78.1 2.2	78.1 2.2	70
65	79.8 1.9	79.1 2.0	78.4 2.1	77.6 2.2	76.9 2.3	76.1 2.4	75.5 2.5	75.0 2.6	74.6 2.6	74.3 2.6	74.1 2.6	74.0 2.5	65
60	76.3 2.2	75.5 2.3	74.7 2.5	73.8 2.6	73.0 2.7	72.2 2.7	71.4 2.8	70.8 2.8	70.4 2.8	70.0 2.8	69.9 2.7	69.8 2.6	60
55	72.4 2.5	71.6 2.7	70.6 2.8	69.7 2.9	68.8 3.0	67.9 3.0	67.2 3.0	66.5 2.9	66.0 2.8	65.7 2.7	65.6 2.6	65.6 2.4	55
50	68.0 2.9	67.2 3.0	66.2 3.1	65.3 3.2	64.3 3.2	63.4 3.1	62.6 3.0	62.0 2.8	61.5 2.6	61.2 2.4	61.1 2.2	61.2 1.9	50
45	63.1 3.2	62.3 3.3	61.4 3.4	60.4 3.3	59.4 3.3	58.5 3.1	57.8 2.9	57.2 2.6	56.8 2.3	56.6 1.9	56.6 1.5	56.8 1.2	45
40	57.7 3.5	56.9 3.5	55.9 3.5	55.0 3.5	54.0 3.3	53.2 3.1	52.5 2.8	52.0 2.4	51.7 1.9	51.7 1.4	51.9 0.8	52.3 0.3	40
35	51.4 3.7	50.7 3.7	49.8 3.6	48.8 3.5	47.9 3.3	47.2 3.1	46.6 2.8	46.2 2.3	46.1 1.7	46.3 1.0	46.8 0.2	47.5 -0.4	35
30	44.2 4.0	43.5 3.7	42.7 3.5	41.8 3.3	41.0 3.2	40.4 3.1	40.0 2.8	39.8 2.3	40.0 1.7	40.5 0.9	41.3 0.0	42.3 -0.8	30
25	35.9 4.1	35.3 3.7	34.6 3.3	33.8 3.1	33.2 3.0	32.7 3.0	32.5 2.9	32.6 2.6	33.1 2.0	33.9 1.2	35.1 0.2	36.5 -0.7	25
20	26.5 4.3	26.0 3.5	25.4 3.0	24.7 2.7	24.3 2.7	24.0 2.9	24.1 3.1	24.5 3.0	25.3 2.6	26.5 1.9	28.0 0.9	29.8 -0.2	20
15	16.0 4.3	15.6 3.3	15.2 2.5	14.7 2.2	14.5 2.3	14.5 2.8	14.8 3.3	15.6 3.5	16.7 3.4	18.2 2.8	20.0 1.8	22.1 0.7	15
10	4.7 4.1	4.6 2.9	4.3 2.0	4.1 1.6	4.1 1.9	4.3 2.6	4.9 3.3	5.9 3.9	7.3 4.0	9.0 3.6	11.1 2.8	13.3 1.6	10
5	-6.7 3.8	-6.7 2.4	-6.8 1.5	-6.8 1.2	-6.6 1.6	-6.1 2.4	-5.3 3.3	-4.1 4.1	-2.6 4.4	-0.8 4.2	1.4 3.5	3.7 2.4	5
0	-17.8 3.4	-17.6 2.1	-17.5 1.2	-17.4 0.9	-17.0 1.3	-16.3 2.2	-15.4 3.1	-14.2 3.9	-12.7 4.4	-10.8 4.3	-8.7 3.7	-6.5 2.7	0
Lat E. Long	120	125	130	135	140	145	150	155	160	165	170	175	Lat E. Long

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E. Long Lat	180	185	190	195	200	205	210	215	220	225	230	235	E. Long Lat
90	87.8 0.5	87.8 0.5	87.8 0.5	87.8 0.5	87.8 0.5	87.8 0.5	87.8 0.5	87.8 0.5	87.8 0.5	87.8 0.5	87.8 0.5	87.8 0.5	90
85	88.5 1.2	88.5 1.2	88.6 1.2	88.6 1.2	88.7 1.3	88.8 1.3	88.9 1.3	89.0 1.4	89.1 1.4	89.2 1.5	89.3 1.5	89.3 1.4	85
80	85.5 1.3	85.5 1.3	85.6 1.3	85.8 1.2	86.0 1.2	86.2 1.1	86.5 1.1	86.8 1.0	87.1 1.0	87.5 0.9	87.9 0.9	88.3 0.8	80
75	82.0 1.7	82.0 1.7	82.2 1.6	82.4 1.5	82.7 1.4	83.1 1.3	83.5 1.2	84.0 1.1	84.5 0.9	85.1 0.8	85.7 0.6	86.3 0.4	75
70	78.1 2.2	78.3 2.1	78.5 2.0	78.8 1.8	79.2 1.7	79.7 1.5	80.3 1.3	81.0 1.0	81.7 0.8	82.4 0.6	83.2 0.3	84.0 0.0	70
65	74.1 2.4	74.3 2.3	74.6 2.2	75.0 2.0	75.5 1.7	76.2 1.5	76.9 1.2	77.6 0.9	78.5 0.5	79.4 0.2	80.3 -0.1	81.3 -0.4	65
60	69.9 2.5	70.2 2.3	70.6 2.1	71.1 1.9	71.7 1.6	72.4 1.2	73.2 0.9	74.1 0.5	75.1 0.2	76.1 -0.2	77.1 -0.5	78.2 -0.8	60
55	65.7 2.2	66.0 2.0	66.5 1.8	67.0 1.5	67.7 1.2	68.5 0.9	69.4 0.5	70.4 0.1	71.4 -0.3	72.5 -0.6	73.6 -0.9	74.7 -1.1	55
50	61.5 1.7	61.9 1.5	62.4 1.2	63.0 1.0	63.8 0.7	64.6 0.4	65.5 0.0	66.5 -0.4	67.6 -0.8	68.7 -1.0	69.8 -1.3	70.9 -1.4	50
45	57.2 0.9	57.7 0.6	58.4 0.4	59.1 0.2	59.9 0.0	60.7 -0.3	61.6 -0.6	62.6 -0.9	63.7 -1.2	64.7 -1.4	65.8 -1.5	67.0 -1.5	45
40	52.9 -0.1	53.6 -0.3	54.4 -0.5	55.2 -0.6	56.0 -0.8	56.8 -0.9	57.7 -1.2	58.6 -1.4	59.6 -1.6	60.7 -1.7	61.7 -1.7	62.8 -1.6	40
35	48.4 -0.9	49.3 -1.2	50.2 -1.4	51.1 -1.5	52.0 -1.5	52.8 -1.6	53.6 -1.7	54.5 -1.9	55.4 -2.0	56.4 -2.0	57.4 -1.8	58.4 -1.5	35
30	43.5 -1.5	44.7 -1.9	45.8 -2.1	46.8 -2.2	47.7 -2.3	48.4 -2.3	49.2 -2.3	50.0 -2.3	50.8 -2.3	51.7 -2.1	52.6 -1.9	53.6 -1.5	30
25	38.0 -1.5	39.4 -2.1	40.7 -2.5	41.8 -2.7	42.7 -2.8	43.4 -2.9	44.1 -2.8	44.8 -2.8	45.6 -2.6	46.4 -2.3	47.3 -1.9	48.2 -1.3	25
20	31.6 -1.2	33.3 -2.0	34.7 -2.6	35.9 -3.1	36.8 -3.3	37.5 -3.4	38.2 -3.4	38.8 -3.2	39.6 -2.9	40.3 -2.4	41.2 -1.8	42.1 -1.1	20
15	24.1 -0.5	26.0 -1.5	27.6 -2.5	28.8 -3.2	29.7 -3.7	30.4 -4.0	31.1 -4.0	31.8 -3.7	32.5 -3.2	33.3 -2.4	34.1 -1.6	34.9 -0.7	15
10	15.5 0.3	17.5 -1.0	19.1 -2.2	20.4 -3.3	21.3 -4.1	22.1 -4.5	22.8 -4.6	23.6 -4.2	24.3 -3.4	25.1 -2.4	25.9 -1.3	26.8 -0.3	10
5	5.9 1.0	7.9 -0.5	9.6 -1.9	10.9 -3.2	11.9 -4.3	12.7 -4.9	13.5 -5.0	14.3 -4.5	15.1 -3.6	16.0 -2.3	16.9 -1.0	17.8 0.3	5
0	-4.3 1.4	-2.4 -0.1	-0.7 -1.7	0.6 -3.2	1.6 -4.4	2.5 -5.1	3.4 -5.3	4.3 -4.7	5.2 -3.6	6.2 -2.1	7.1 -0.5	8.1 0.8	0
Lat E. Long	180	185	190	195	200	205	210	215	220	225	230	235	Lat E. Long

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E. Long	240	245	250	255	260	265	270	275	280	285	290	295	E. Long
Lat 90	87.8 0.5	87.8 0.5	87.8 0.5	87.8 0.5	87.8 0.5	87.8 0.5	87.8 0.5	87.8 0.5	87.8 0.5	87.8 0.5	87.8 0.5	87.8 0.5	Lat 90
85	89.2 1.2	89.1 0.9	88.9 0.7	88.8 0.6	88.5 0.5	88.3 0.4	88.1 0.4	87.9 0.3	87.6 0.3	87.4 0.3	87.2 0.3	87.0 0.3	85
80	88.7 0.8	89.2 0.9	89.7 1.2	89.8 0.8	89.3 0.0	88.8 -0.1	88.3 -0.1	87.9 -0.1	87.4 -0.1	86.9 0.0	86.5 0.0	86.0 0.1	80
75	87.0 0.2	87.7 -0.1	88.3 -0.6	88.9 -1.4	89.2 -2.4	88.9 -2.0	88.3 -1.5	87.6 -1.1	86.9 -0.9	86.2 -0.7	85.6 -0.5	84.9 -0.4	75
70	84.9 -0.3	85.7 -0.7	86.5 -1.1	87.1 -1.7	87.6 -2.4	87.7 -2.7	87.3 -2.6	86.7 -2.2	85.9 -1.9	85.1 -1.6	84.3 -1.3	83.5 -1.1	70
65	82.3 -0.7	83.2 -1.1	84.1 -1.5	84.8 -1.9	85.4 -2.4	85.6 -2.8	85.5 -2.9	85.0 -2.9	84.3 -2.7	83.5 -2.4	82.6 -2.2	81.7 -1.9	65
60	79.2 -1.1	80.2 -1.3	81.2 -1.6	82.0 -1.9	82.6 -2.3	82.9 -2.6	83.0 -2.9	82.6 -3.1	82.0 -3.1	81.2 -3.0	80.3 -2.9	79.3 -2.6	60
55	75.8 -1.3	76.8 -1.4	77.8 -1.6	78.7 -1.7	79.4 -2.0	79.8 -2.3	80.0 -2.7	79.8 -3.1	79.3 -3.3	78.5 -3.4	77.6 -3.4	76.6 -3.3	55
50	72.1 -1.4	73.2 -1.4	74.2 -1.4	75.1 -1.4	75.9 -1.6	76.4 -1.9	76.6 -2.4	76.5 -2.9	76.1 -3.4	75.4 -3.7	74.5 -3.9	73.4 -3.9	50
45	68.1 -1.4	69.2 -1.2	70.3 -1.0	71.3 -1.0	72.1 -1.1	72.7 -1.4	73.0 -1.9	73.0 -2.6	72.7 -3.3	72.0 -3.9	71.1 -4.3	70.0 -4.5	45
40	64.0 -1.3	65.1 -1.0	66.2 -0.7	67.2 -0.5	68.1 -0.5	68.7 -0.8	69.2 -1.4	69.2 -2.3	69.0 -3.2	68.3 -4.1	67.4 -4.8	66.2 -5.2	40
35	59.5 -1.1	60.6 -0.7	61.7 -0.2	62.8 0.0	63.8 0.1	64.5 -0.2	65.0 -0.9	65.2 -1.9	65.0 -3.0	64.4 -4.2	63.5 -5.2	62.2 -6.0	35
30	54.7 -0.9	55.8 -0.3	56.9 0.2	58.0 0.6	59.0 0.6	59.9 0.4	60.5 -0.3	60.8 -1.4	60.7 -2.8	60.1 -4.3	59.2 -5.7	57.9 -6.9	30
25	49.3 -0.6	50.3 0.0	51.5 0.6	52.7 1.0	53.8 1.2	54.8 0.9	55.5 0.2	56.0 -0.9	56.0 -2.5	55.5 -4.3	54.6 -6.1	53.2 -7.8	25
20	43.0 -0.3	44.1 0.4	45.3 1.0	46.6 1.5	47.9 1.7	49.1 1.5	50.0 0.8	50.6 -0.4	50.8 -2.1	50.5 -4.2	49.6 -6.5	48.1 -8.7	20
15	35.9 0.1	37.0 0.9	38.3 1.5	39.7 1.9	41.2 2.1	42.6 2.0	43.8 1.4	44.7 0.3	45.1 -1.5	44.9 -3.9	44.0 -6.6	42.5 -9.4	15
10	27.8 0.6	29.0 1.4	30.4 1.9	31.9 2.3	33.6 2.5	35.3 2.5	36.8 2.0	38.0 0.9	38.6 -0.9	38.6 -3.4	37.8 -6.5	36.2 -9.9	10
5	18.8 1.2	20.1 1.9	21.5 2.4	23.3 2.7	25.2 2.8	27.2 2.9	29.0 2.5	30.5 1.6	31.4 -0.1	31.5 -2.7	30.8 -6.0	29.2 -9.9	5
0 Lat	9.2 1.8	10.5 2.4	12.1 2.7	13.9 2.9	16.0 3.0	18.2 3.1	20.3 2.9	22.1 2.2	23.3 0.7	23.7 -1.9	23.1 -5.4	21.4 -9.5	0 Lat
E. Long	240	245	250	255	260	265	270	275	280	285	290	295	E. Long

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E. Long Lat	300	305	310	315	320	325	330	335	340	345	350	355	E. Long Lat
90	87.8 0.5	87.8 0.5	87.8 0.5	87.8 0.5	87.8 0.5	87.8 0.5	87.8 0.5	87.8 0.5	87.8 0.5	87.8 0.5	87.8 0.5	87.8 0.5	90
85	86.8 0.3	86.6 0.3	86.4 0.3	86.2 0.4	86.0 0.4	85.9 0.4	85.7 0.4	85.6 0.4	85.5 0.4	85.4 0.4	85.4 0.5	85.3 0.5	85
80	85.6 0.1	85.2 0.2	84.8 0.2	84.5 0.2	84.2 0.3	83.9 0.3	83.7 0.4	83.4 0.4	83.3 0.4	83.1 0.5	83.0 0.5	82.9 0.5	80
75	84.3 -0.3	83.7 -0.2	83.2 -0.1	82.7 0.0	82.3 0.0	81.9 0.1	81.6 0.2	81.3 0.3	81.0 0.3	80.8 0.4	80.6 0.4	80.5 0.5	75
70	82.8 -0.9	82.0 -0.8	81.4 -0.6	80.8 -0.5	80.2 -0.3	79.7 -0.2	79.3 -0.1	78.9 0.0	78.6 0.1	78.4 0.2	78.2 0.3	78.1 0.4	70
65	80.8 -1.7	79.9 -1.4	79.1 -1.2	78.4 -1.0	77.8 -0.8	77.2 -0.7	76.8 -0.5	76.4 -0.4	76.0 -0.2	75.8 -0.1	75.6 0.0	75.5 0.2	65
60	78.4 -2.4	77.4 -2.1	76.5 -1.9	75.7 -1.6	75.0 -1.4	74.4 -1.2	73.8 -1.0	73.4 -0.8	73.0 -0.6	72.8 -0.5	72.6 -0.3	72.5 -0.1	60
55	75.5 -3.1	74.5 -2.8	73.5 -2.5	72.6 -2.3	71.7 -2.0	71.0 -1.8	70.5 -1.6	70.0 -1.4	69.6 -1.2	69.3 -0.9	69.2 -0.6	69.1 -0.3	55
50	72.3 -3.8	71.1 -3.6	70.0 -3.3	69.0 -3.0	68.0 -2.8	67.2 -2.6	66.6 -2.4	66.0 -2.1	65.6 -1.8	65.3 -1.5	65.2 -1.1	65.2 -0.7	50
45	68.7 -4.5	67.4 -4.4	66.1 -4.2	64.9 -4.0	63.9 -3.8	62.9 -3.5	62.1 -3.3	61.5 -3.0	61.0 -2.7	60.7 -2.2	60.5 -1.6	60.5 -1.0	45
40	64.8 -5.4	63.4 -5.4	61.9 -5.3	60.5 -5.2	59.2 -5.0	58.0 -4.7	57.0 -4.5	56.2 -4.1	55.6 -3.7	55.2 -3.0	54.9 -2.3	54.9 -1.4	40
35	60.7 -6.5	59.0 -6.7	57.3 -6.8	55.6 -6.7	53.9 -6.5	52.5 -6.3	51.2 -6.0	50.1 -5.5	49.3 -4.9	48.7 -4.0	48.4 -3.0	48.3 -1.9	35
30	56.2 -7.8	54.3 -8.3	52.3 -8.6	50.2 -8.6	48.1 -8.5	46.2 -8.2	44.5 -7.7	43.0 -7.1	41.9 -6.3	41.1 -5.1	40.6 -3.8	40.5 -2.4	30
25	51.4 -9.2	49.2 -10.1	46.8 -10.7	44.2 -10.9	41.6 -10.8	39.1 -10.5	36.8 -9.9	34.8 -9.0	33.3 -7.8	32.2 -6.4	31.5 -4.7	31.3 -3.0	25
20	46.1 -10.6	43.6 -12.1	40.7 -13.1	37.5 -13.6	34.3 -13.5	31.0 -13.1	28.1 -12.2	25.5 -11.1	23.5 -9.5	22.0 -7.7	21.1 -5.7	20.7 -3.7	20
15	40.3 -12.0	37.5 -14.1	34.1 -15.6	30.2 -16.4	26.2 -16.4	22.2 -15.8	18.4 -14.7	15.2 -13.2	12.6 -11.3	10.7 -9.1	9.5 -6.7	9.0 -4.5	15
10	33.8 -13.1	30.7 -15.9	26.7 -18.0	22.3 -19.1	17.4 -19.2	12.6 -18.5	8.1 -17.1	4.2 -15.1	1.0 -12.8	-1.2 -10.3	-2.7 -7.8	-3.4 -5.4	10
5	26.6 -13.8	23.1 -17.2	18.8 -19.8	13.7 -21.3	8.3 -21.5	2.7 -20.7	-2.4 -19.0	-6.9 -16.7	-10.4 -14.1	-13.0 -11.4	-14.7 -8.7	-15.7 -6.3	5
0	18.7 -13.9	14.9 -17.9	10.2 -20.9	4.8 -22.6	-1.1 -22.9	-7.0 -22.0	-12.5 -20.2	-17.3 -17.7	-21.1 -15.0	-24.0 -12.3	-25.9 -9.7	-27.1 -7.4	0
Lat E. Long	300	305	310	315	320	325	330	335	340	345	350	355	Lat E. Long

INCLINATION (I) WMM-95

E. Long	0	5	10	15	20	25	30	35	40	45	50	55	E. Long
Lat													Lat
0	-27.8 -5.5	-28.1 -4.2	-28.0 -3.5	-27.8 -3.2	-27.2 -3.0	-26.3 -2.6	-25.1 -1.9	-23.5 -0.9	-21.8 0.3	-20.2 1.4	-19.1 1.9	-18.5 1.6	0
-5	-38.2 -6.6	-38.7 -5.3	-38.9 -4.4	-38.8 -3.8	-38.4 -3.3	-37.5 -2.6	-36.3 -1.7	-34.7 -0.6	-33.0 0.5	-31.4 1.4	-30.2 1.7	-29.6 1.3	-5
-10	-46.8 -7.8	-47.7 -6.3	-48.2 -5.2	-48.3 -4.3	-47.9 -3.4	-47.2 -2.5	-45.9 -1.4	-44.3 -0.3	-42.6 0.8	-41.1 1.5	-39.9 1.6	-39.3 1.0	-10
-15	-53.6 -8.8	-54.8 -7.3	-55.6 -5.9	-55.9 -4.6	-55.7 -3.4	-54.9 -2.2	-53.7 -0.9	-52.2 0.2	-50.5 1.2	-49.0 1.6	-47.9 1.5	-47.3 0.8	-15
-20	-58.7 -9.5	-60.1 -7.9	-61.1 -6.2	-61.5 -4.7	-61.3 -3.1	-60.6 -1.6	-59.4 -0.2	-57.9 1.0	-56.3 1.7	-54.9 2.0	-53.9 1.6	-53.3 0.6	-20
-25	-62.2 -9.6	-63.7 -7.9	-64.7 -6.1	-65.1 -4.2	-64.9 -2.4	-64.2 -0.6	-62.9 0.9	-61.5 2.0	-59.9 2.5	-58.7 2.4	-57.9 1.6	-57.5 0.5	-25
-30	-64.3 -8.7	-65.6 -7.0	-66.4 -5.0	-66.7 -3.0	-66.4 -1.0	-65.5 0.8	-64.3 2.2	-62.9 3.0	-61.6 3.2	-60.6 2.6	-60.1 1.6	-60.1 0.2	-30
-35	-65.0 -6.8	-66.0 -5.0	-66.5 -3.1	-66.6 -1.0	-66.1 0.8	-65.1 2.4	-63.9 3.4	-62.7 3.8	-61.8 3.4	-61.2 2.5	-61.1 1.2	-61.5 -0.1	-35
-40	-64.5 -4.0	-65.2 -2.3	-65.4 -0.5	-65.2 1.3	-64.6 2.7	-63.7 3.8	-62.7 4.2	-61.8 4.0	-61.3 3.2	-61.2 2.1	-61.5 0.8	-62.3 -0.4	-40
-45	-63.2 -0.8	-63.5 0.7	-63.5 2.1	-63.2 3.3	-62.6 4.2	-62.0 4.6	-61.3 4.4	-60.9 3.8	-60.8 2.8	-61.1 1.7	-61.7 0.5	-62.8 -0.5	-45
-50	-61.4 2.1	-61.6 3.2	-61.6 4.1	-61.3 4.7	-61.0 5.0	-60.6 4.8	-60.4 4.3	-60.4 3.5	-60.6 2.5	-61.2 1.5	-62.1 0.5	-63.2 -0.3	-50
-55	-60.0 3.9	-60.1 4.6	-60.2 5.1	-60.1 5.3	-60.0 5.2	-60.0 4.8	-60.1 4.2	-60.4 3.4	-60.9 2.5	-61.7 1.7	-62.7 0.9	-63.9 0.3	-55
-60	-59.5 4.6	-59.6 5.0	-59.7 5.3	-59.9 5.2	-60.0 5.0	-60.2 4.6	-60.5 4.0	-61.0 3.4	-61.7 2.8	-62.5 2.1	-63.5 1.6	-64.6 1.1	-60
-65	-60.0 4.5	-60.2 4.8	-60.4 4.9	-60.6 4.8	-60.9 4.6	-61.2 4.3	-61.7 3.9	-62.2 3.5	-62.9 3.1	-63.7 2.6	-64.6 2.3	-65.7 1.9	-65
-70	-61.5 4.0	-61.7 4.2	-61.9 4.3	-62.2 4.3	-62.5 4.2	-62.9 4.0	-63.3 3.8	-63.9 3.5	-64.5 3.3	-65.2 3.0	-66.1 2.8	-67.0 2.6	-70
-75	-63.8 3.5	-63.9 3.6	-64.2 3.7	-64.4 3.7	-64.7 3.7	-65.1 3.6	-65.5 3.5	-66.0 3.4	-66.5 3.3	-67.1 3.2	-67.7 3.0	-68.5 2.9	-75
-80	-66.6 3.0	-66.7 3.1	-66.9 3.2	-67.1 3.2	-67.3 3.2	-67.6 3.2	-67.9 3.2	-68.3 3.2	-68.7 3.1	-69.1 3.1	-69.6 3.0	-70.1 3.0	-80
-85	-69.7 2.7	-69.8 2.7	-69.9 2.7	-70.0 2.8	-70.2 2.8	-70.3 2.8	-70.5 2.8	-70.7 2.8	-70.9 2.8	-71.2 2.8	-71.4 2.8	-71.7 2.7	-85
-90	-73.0 2.4	-73.0 2.4	-73.0 2.4	-73.0 2.4	-73.0 2.4	-73.0 2.4	-73.0 2.4	-73.0 2.4	-73.0 2.4	-73.0 2.4	-73.0 2.4	-73.0 2.4	-90
Lat													Lat
E. Long	0	5	10	15	20	25	30	35	40	45	50	55	E. Long

INCLINATION (I) WMM-95

E. Long	60	65	70	75	80	85	90	95	100	105	110	115	E. Long
Lat 0	-18.4 0.8	-18.8 -0.4	-19.3 -1.4	-19.8 -1.8	-20.2 -1.4	-20.6 -0.2	-20.7 1.5	-20.5 3.3	-20.1 4.8	-19.5 5.6	-18.8 5.5	-18.2 4.6	Lat 0
-5	-29.5 0.4	-29.8 -0.8	-30.2 -1.7	-30.7 -2.0	-31.1 -1.6	-31.4 -0.5	-31.4 1.1	-31.2 2.8	-30.8 4.2	-30.1 4.9	-29.3 4.8	-28.7 4.0	-5
-10	-39.2 0.0	-39.3 -1.1	-39.7 -2.0	-40.2 -2.3	-40.6 -1.9	-40.8 -0.8	-40.9 0.6	-40.7 2.1	-40.2 3.3	-39.5 4.0	-38.8 4.0	-38.0 3.4	-10
-15	-47.1 -0.3	-47.3 -1.4	-47.7 -2.2	-48.1 -2.5	-48.5 -2.2	-48.8 -1.3	-48.9 0.0	-48.8 1.3	-48.4 2.4	-47.7 3.1	-47.0 3.2	-46.3 2.8	-15
-20	-53.3 -0.5	-53.5 -1.7	-54.0 -2.5	-54.6 -2.8	-55.1 -2.5	-55.5 -1.7	-55.7 -0.6	-55.6 0.5	-55.3 1.5	-54.8 2.2	-54.1 2.4	-53.4 2.3	-20
-25	-57.7 -0.8	-58.1 -1.9	-58.8 -2.7	-59.5 -3.0	-60.2 -2.8	-60.8 -2.2	-61.2 -1.3	-61.3 -0.2	-61.2 0.7	-60.8 1.3	-60.3 1.7	-59.6 1.7	-25
-30	-60.6 -1.1	-61.3 -2.2	-62.3 -2.9	-63.2 -3.2	-64.2 -3.1	-65.0 -2.6	-65.6 -1.8	-66.0 -0.9	-66.1 -0.1	-65.9 0.5	-65.5 1.0	-65.0 1.2	-30
-35	-62.3 -1.3	-63.4 -2.3	-64.6 -2.9	-65.9 -3.2	-67.1 -3.1	-68.2 -2.7	-69.1 -2.1	-69.8 -1.4	-70.1 -0.7	-70.2 -0.2	-70.0 0.3	-69.7 0.6	-35
-40	-63.4 -1.5	-64.7 -2.2	-66.1 -2.7	-67.6 -2.9	-69.1 -2.9	-70.5 -2.6	-71.7 -2.2	-72.7 -1.7	-73.4 -1.2	-73.8 -0.7	-73.9 -0.3	-73.8 0.1	-40
-45	-64.1 -1.3	-65.5 -1.9	-67.1 -2.3	-68.8 -2.4	-70.4 -2.4	-72.0 -2.2	-73.5 -2.0	-74.8 -1.7	-75.9 -1.4	-76.7 -1.1	-77.2 -0.7	-77.4 -0.4	-45
-50	-64.6 -0.9	-66.2 -1.3	-67.8 -1.6	-69.5 -1.6	-71.3 -1.6	-73.0 -1.5	-74.6 -1.4	-76.2 -1.3	-77.6 -1.2	-78.8 -1.1	-79.8 -1.0	-80.4 -0.8	-50
-55	-65.2 -0.1	-66.7 -0.5	-68.4 -0.6	-70.0 -0.7	-71.8 -0.7	-73.5 -0.7	-75.3 -0.6	-77.0 -0.6	-78.6 -0.6	-80.2 -0.7	-81.5 -0.7	-82.7 -0.8	-55
-60	-65.9 0.8	-67.4 0.5	-68.9 0.4	-70.5 0.3	-72.1 0.3	-73.8 0.3	-75.5 0.3	-77.2 0.3	-78.9 0.2	-80.5 0.1	-82.1 0.0	-83.7 -0.2	-60
-65	-66.8 1.7	-68.1 1.5	-69.4 1.3	-70.9 1.3	-72.3 1.2	-73.8 1.2	-75.4 1.1	-76.9 1.1	-78.5 1.0	-80.0 1.0	-81.6 0.9	-83.1 0.7	-65
-70	-67.9 2.4	-69.0 2.2	-70.1 2.1	-71.3 2.0	-72.5 2.0	-73.8 1.9	-75.1 1.8	-76.4 1.8	-77.7 1.7	-79.0 1.7	-80.3 1.6	-81.5 1.5	-70
-75	-69.2 2.8	-70.1 2.7	-70.9 2.6	-71.9 2.5	-72.8 2.4	-73.8 2.4	-74.7 2.3	-75.7 2.2	-76.7 2.2	-77.7 2.1	-78.6 2.1	-79.6 2.0	-75
-80	-70.6 2.9	-71.2 2.8	-71.8 2.8	-72.4 2.7	-73.1 2.7	-73.7 2.6	-74.4 2.6	-75.0 2.5	-75.6 2.5	-76.3 2.4	-76.9 2.4	-77.5 2.3	-80
-85	-72.0 2.7	-72.3 2.7	-72.6 2.7	-72.9 2.7	-73.2 2.6	-73.5 2.6	-73.8 2.6	-74.2 2.6	-74.5 2.5	-74.8 2.5	-75.0 2.5	-75.3 2.5	-85
-90	-73.0 2.4	-73.0 2.4	-73.0 2.4	-73.0 2.4	-73.0 2.4	-73.0 2.4	-73.0 2.4	-73.0 2.4	-73.0 2.4	-73.0 2.4	-73.0 2.4	-73.0 2.4	-90
Lat													Lat
E. Long	60	65	70	75	80	85	90	95	100	105	110	115	E. Long

INCLINATION (I) WMM-95

E. Long	120	125	130	135	140	145	150	155	160	165	170	175	E. Long
Lat 0	-17.8 3.4	-17.6 2.1	-17.5 1.2	-17.4 0.9	-17.0 1.3	-16.3 2.2	-15.4 3.1	-14.2 3.9	-12.7 4.4	-10.8 4.3	-8.7 3.7	-6.5 2.7	Lat 0
-5	-28.2 2.9	-27.8 1.8	-27.6 1.1	-27.2 0.9	-26.7 1.2	-26.0 2.0	-25.1 2.8	-23.9 3.6	-22.4 3.9	-20.7 3.9	-18.7 3.4	-16.7 2.6	-5
-10	-37.5 2.6	-37.0 1.7	-36.6 1.1	-36.2 1.0	-35.7 1.3	-34.9 1.8	-34.0 2.5	-32.9 3.0	-31.5 3.3	-29.9 3.2	-28.2 2.8	-26.4 2.1	-10
-15	-45.7 2.2	-45.2 1.7	-44.7 1.3	-44.2 1.2	-43.6 1.3	-42.9 1.7	-42.1 2.1	-41.0 2.4	-39.8 2.5	-38.4 2.4	-36.9 2.0	-35.3 1.5	-15
-20	-52.8 2.0	-52.3 1.6	-51.8 1.4	-51.3 1.3	-50.7 1.4	-50.0 1.6	-49.2 1.7	-48.2 1.8	-47.1 1.8	-45.9 1.6	-44.6 1.3	-43.1 0.9	-20
-25	-59.0 1.7	-58.5 1.5	-58.0 1.4	-57.5 1.4	-56.9 1.4	-56.2 1.4	-55.5 1.4	-54.6 1.3	-53.6 1.2	-52.5 1.0	-51.3 0.7	-50.0 0.4	-25
-30	-64.5 1.3	-63.9 1.3	-63.4 1.3	-62.9 1.3	-62.3 1.3	-61.7 1.3	-61.0 1.1	-60.1 1.0	-59.2 0.7	-58.2 0.5	-57.1 0.3	-55.9 0.0	-30
-35	-69.3 0.9	-68.8 1.0	-68.3 1.1	-67.7 1.2	-67.1 1.2	-66.5 1.1	-65.8 0.9	-65.0 0.7	-64.1 0.5	-63.1 0.3	-62.1 0.1	-61.0 -0.1	-35
-40	-73.5 0.4	-73.1 0.6	-72.6 0.8	-72.1 0.9	-71.5 0.9	-70.8 0.8	-70.1 0.7	-69.3 0.6	-68.4 0.4	-67.4 0.2	-66.4 0.1	-65.4 0.0	-40
-45	-77.3 -0.1	-77.1 0.1	-76.6 0.3	-76.1 0.5	-75.5 0.6	-74.8 0.6	-74.0 0.5	-73.1 0.5	-72.2 0.4	-71.3 0.3	-70.3 0.2	-69.3 0.2	-45
-50	-80.7 -0.6	-80.7 -0.4	-80.4 -0.2	-79.9 0.0	-79.3 0.2	-78.5 0.3	-77.6 0.3	-76.7 0.4	-75.8 0.4	-74.8 0.4	-73.8 0.4	-72.8 0.4	-50
-55	-83.5 -0.9	-83.9 -0.8	-83.9 -0.7	-83.6 -0.5	-82.9 -0.2	-82.1 0.0	-81.1 0.1	-80.1 0.3	-79.1 0.4	-78.1 0.4	-77.1 0.5	-76.1 0.5	-55
-60	-85.1 -0.5	-86.2 -0.8	-87.0 -1.0	-87.0 -1.0	-86.5 -0.6	-85.5 -0.3	-84.5 0.0	-83.4 0.2	-82.3 0.4	-81.2 0.5	-80.1 0.6	-79.1 0.7	-60
-65	-84.6 0.6	-86.1 0.5	-87.5 0.4	-88.9 0.3	-89.7 0.8	-88.4 0.4	-87.2 0.4	-86.0 0.6	-84.8 0.7	-83.7 0.8	-82.7 0.9	-81.6 1.0	-65
-70	-82.8 1.5	-83.9 1.4	-84.9 1.4	-85.8 1.5	-86.5 1.6	-86.8 1.6	-86.6 1.6	-86.1 1.5	-85.5 1.4	-84.7 1.4	-83.8 1.4	-82.9 1.4	-70
-75	-80.4 2.0	-81.2 1.9	-81.9 1.9	-82.5 1.9	-83.0 1.9	-83.4 1.9	-83.5 1.9	-83.5 1.9	-83.4 1.8	-83.1 1.8	-82.7 1.8	-82.2 1.8	-75
-80	-78.0 2.3	-78.5 2.2	-78.9 2.2	-79.3 2.2	-79.6 2.2	-79.9 2.1	-80.1 2.1	-80.1 2.1	-80.1 2.1	-80.1 2.1	-79.9 2.1	-79.7 2.1	-80
-85	-75.5 2.4	-75.8 2.4	-76.0 2.4	-76.2 2.4	-76.3 2.3	-76.4 2.3	-76.5 2.3	-76.6 2.3	-76.6 2.3	-76.6 2.3	-76.6 2.3	-76.5 2.3	-85
-90	-73.0 2.4	-73.0 2.4	-73.0 2.4	-73.0 2.4	-73.0 2.4	-73.0 2.4	-73.0 2.4	-73.0 2.4	-73.0 2.4	-73.0 2.4	-73.0 2.4	-73.0 2.4	-90
Lat													Lat
E. Long	120	125	130	135	140	145	150	155	160	165	170	175	E. Long

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E. Long	180	185	190	195	200	205	210	215	220	225	230	235	E. Long
Lat													Lat
0	-4.3 1.4	-2.4 -0.1	-0.7 -1.7	0.6 -3.2	1.6 -4.4	2.5 -5.1	3.4 -5.3	4.3 -4.7	5.2 -3.6	6.2 -2.1	7.1 -0.5	8.1 0.8	0
-5	-14.6 1.4	-12.8 0.0	-11.3 -1.5	-10.0 -3.0	-8.9 -4.2	-8.0 -5.0	-7.0 -5.2	-6.0 -4.6	-5.0 -3.4	-3.9 -1.8	-2.9 -0.2	-1.8 1.2	-5
-10	-24.6 1.1	-22.9 -0.1	-21.5 -1.4	-20.2 -2.8	-19.2 -3.9	-18.2 -4.7	-17.1 -4.8	-16.1 -4.3	-14.9 -3.1	-13.8 -1.5	-12.7 0.1	-11.6 1.5	-10
-15	-33.7 0.7	-32.2 -0.3	-30.8 -1.4	-29.6 -2.5	-28.6 -3.5	-27.5 -4.2	-26.5 -4.3	-25.4 -3.8	-24.2 -2.7	-23.0 -1.3	-21.9 0.2	-20.7 1.4	-15
-20	-41.7 0.3	-40.4 -0.5	-39.1 -1.3	-38.0 -2.2	-37.0 -3.0	-35.9 -3.6	-34.8 -3.7	-33.7 -3.2	-32.5 -2.3	-31.4 -1.1	-30.2 0.1	-29.1 1.2	-20
-25	-48.7 -0.1	-47.5 -0.6	-46.3 -1.2	-45.3 -1.9	-44.2 -2.5	-43.2 -3.0	-42.1 -3.0	-41.0 -2.7	-39.9 -2.0	-38.8 -1.0	-37.6 0.0	-36.5 0.8	-25
-30	-54.8 -0.3	-53.6 -0.6	-52.5 -1.1	-51.5 -1.6	-50.5 -2.1	-49.4 -2.4	-48.4 -2.5	-47.4 -2.2	-46.3 -1.7	-45.2 -1.0	-44.2 -0.2	-43.1 0.5	-30
-35	-59.9 -0.3	-58.8 -0.5	-57.8 -0.9	-56.8 -1.2	-55.8 -1.6	-54.8 -1.8	-53.9 -1.9	-52.9 -1.7	-51.9 -1.4	-50.9 -0.8	-49.8 -0.2	-48.8 0.3	-35
-40	-64.4 -0.1	-63.3 -0.3	-62.4 -0.6	-61.4 -0.8	-60.5 -1.1	-59.5 -1.3	-58.6 -1.4	-57.7 -1.3	-56.8 -1.0	-55.8 -0.6	-54.8 -0.1	-53.7 0.4	-40
-45	-68.3 0.1	-67.3 0.0	-66.4 -0.2	-65.4 -0.4	-64.6 -0.6	-63.7 -0.7	-62.8 -0.8	-61.9 -0.7	-61.0 -0.5	-60.0 -0.2	-59.0 0.2	-57.9 0.6	-45
-50	-71.8 0.3	-70.9 0.3	-70.0 0.2	-69.1 0.0	-68.2 -0.1	-67.3 -0.2	-66.5 -0.2	-65.6 -0.1	-64.7 0.1	-63.7 0.4	-62.6 0.7	-61.5 1.1	-50
-55	-75.1 0.6	-74.1 0.5	-73.2 0.5	-72.3 0.5	-71.5 0.4	-70.6 0.4	-69.7 0.5	-68.8 0.6	-67.9 0.8	-66.8 1.0	-65.7 1.3	-64.5 1.6	-55
-60	-78.1 0.8	-77.1 0.8	-76.2 0.8	-75.3 0.9	-74.4 0.9	-73.5 1.0	-72.6 1.1	-71.6 1.2	-70.6 1.4	-69.5 1.6	-68.4 1.8	-67.2 2.0	-60
-65	-80.6 1.1	-79.7 1.1	-78.7 1.2	-77.8 1.3	-76.8 1.4	-75.9 1.5	-74.9 1.6	-73.9 1.7	-72.9 1.8	-71.8 2.0	-70.7 2.1	-69.5 2.2	-65
-70	-82.1 1.5	-81.2 1.5	-80.3 1.6	-79.4 1.7	-78.5 1.7	-77.5 1.8	-76.6 1.9	-75.6 2.0	-74.6 2.1	-73.6 2.2	-72.6 2.2	-71.5 2.3	-70
-75	-81.6 1.9	-81.0 1.9	-80.3 1.9	-79.6 2.0	-78.8 2.0	-78.1 2.0	-77.3 2.1	-76.4 2.1	-75.6 2.2	-74.7 2.2	-73.9 2.2	-73.0 2.2	-75
-80	-79.4 2.1	-79.1 2.1	-78.7 2.1	-78.3 2.1	-77.8 2.1	-77.3 2.1	-76.8 2.1	-76.2 2.1	-75.6 2.1	-75.0 2.1	-74.4 2.1	-73.8 2.1	-80
-85	-76.4 2.2	-76.3 2.2	-76.1 2.2	-75.9 2.2	-75.7 2.2	-75.5 2.2	-75.2 2.2	-75.0 2.2	-74.7 2.2	-74.4 2.2	-74.1 2.2	-73.8 2.2	-85
-90	-73.0 2.4	-73.0 2.4	-73.0 2.4	-73.0 2.4	-73.0 2.4	-73.0 2.4	-73.0 2.4	-73.0 2.4	-73.0 2.4	-73.0 2.4	-73.0 2.4	-73.0 2.4	-90
Lat													Lat
E. Long	180	185	190	195	200	205	210	215	220	225	230	235	E. Long

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E. Long	240	245	250	255	260	265	270	275	280	285	290	295	E. Long
Lat													Lat
0	9.2 1.8	10.5 2.4	12.1 2.7	13.9 2.9	16.0 3.0	18.2 3.1	20.3 2.9	22.1 2.2	23.3 0.7	23.7 -1.9	23.1 -5.4	21.4 -9.5	0
-5	-0.7 2.2	0.6 2.7	2.2 2.9	4.1 2.9	6.2 3.0	8.5 3.1	10.8 3.1	12.9 2.6	14.3 1.3	15.0 -1.1	14.5 -4.5	12.9 -8.8	-5
-10	-10.4 2.3	-9.1 2.8	-7.6 2.8	-5.8 2.8	-3.7 2.8	-1.4 2.9	1.0 3.0	3.2 2.7	4.8 1.7	5.7 -0.4	5.4 -3.6	3.9 -7.7	-10
-15	-19.6 2.2	-18.3 2.5	-16.9 2.5	-15.3 2.4	-13.3 2.4	-11.1 2.5	-8.8 2.6	-6.6 2.5	-4.8 1.7	-3.8 0.0	-3.9 -2.8	-5.2 -6.6	-15
-20	-28.0 1.9	-26.8 2.1	-25.5 2.1	-24.0 2.0	-22.2 1.9	-20.2 2.0	-18.0 2.1	-15.9 2.1	-14.1 1.5	-13.0 0.0	-12.9 -2.4	-13.9 -5.6	-20
-25	-35.5 1.4	-34.3 1.7	-33.1 1.7	-31.8 1.6	-30.1 1.5	-28.3 1.6	-26.3 1.6	-24.3 1.5	-22.5 1.0	-21.4 -0.2	-21.0 -2.2	-21.8 -4.9	-25
-30	-42.0 1.0	-40.9 1.3	-39.8 1.3	-38.4 1.3	-36.9 1.2	-35.2 1.2	-33.3 1.1	-31.4 0.9	-29.8 0.4	-28.6 -0.7	-28.2 -2.4	-28.6 -4.5	-30
-35	-47.7 0.8	-46.6 1.0	-45.4 1.1	-44.0 1.2	-42.5 1.1	-40.8 1.0	-39.1 0.8	-37.3 0.5	-35.8 -0.1	-34.6 -1.2	-34.1 -2.6	-34.4 -4.4	-35
-40	-52.6 0.8	-51.4 1.0	-50.1 1.2	-48.7 1.2	-47.1 1.2	-45.5 1.0	-43.8 0.7	-42.2 0.2	-40.7 -0.5	-39.6 -1.5	-39.0 -2.8	-39.1 -4.2	-40
-45	-56.7 1.0	-55.4 1.3	-54.1 1.4	-52.6 1.5	-51.0 1.4	-49.4 1.2	-47.7 0.8	-46.2 0.2	-44.8 -0.6	-43.8 -1.6	-43.2 -2.7	-43.2 -3.9	-45
-50	-60.2 1.4	-58.9 1.6	-57.4 1.8	-55.9 1.8	-54.4 1.6	-52.8 1.4	-51.2 0.9	-49.8 0.3	-48.6 -0.5	-47.6 -1.3	-47.0 -2.3	-46.8 -3.3	-50
-55	-63.2 1.8	-61.9 2.0	-60.4 2.1	-58.9 2.0	-57.4 1.9	-56.0 1.6	-54.5 1.1	-53.2 0.5	-52.1 -0.1	-51.2 -0.9	-50.6 -1.7	-50.3 -2.4	-55
-60	-65.9 2.1	-64.6 2.2	-63.2 2.3	-61.8 2.2	-60.4 2.0	-59.1 1.7	-57.8 1.3	-56.6 0.8	-55.6 0.3	-54.8 -0.3	-54.2 -0.9	-53.9 -1.4	-60
-65	-68.3 2.3	-67.1 2.3	-65.8 2.3	-64.6 2.2	-63.4 2.0	-62.2 1.8	-61.1 1.4	-60.1 1.1	-59.2 0.7	-58.5 0.3	-57.9 0.0	-57.5 -0.3	-65
-70	-70.4 2.3	-69.4 2.3	-68.3 2.2	-67.2 2.1	-66.2 2.0	-65.2 1.8	-64.3 1.6	-63.5 1.4	-62.7 1.1	-62.1 0.9	-61.5 0.7	-61.1 0.6	-70
-75	-72.1 2.2	-71.3 2.2	-70.4 2.1	-69.6 2.0	-68.8 1.9	-68.0 1.8	-67.3 1.7	-66.6 1.6	-66.0 1.5	-65.4 1.4	-64.9 1.4	-64.5 1.3	-75
-80	-73.2 2.1	-72.6 2.1	-72.0 2.1	-71.4 2.0	-70.8 2.0	-70.3 2.0	-69.8 1.9	-69.3 1.9	-68.8 1.9	-68.4 1.9	-68.0 1.9	-67.7 1.9	-80
-85	-73.5 2.2	-73.2 2.2	-72.9 2.2	-72.6 2.2	-72.3 2.2	-72.0 2.2	-71.7 2.2	-71.4 2.2	-71.2 2.2	-71.0 2.2	-70.7 2.2	-70.5 2.3	-85
-90	-73.0 2.4	-73.0 2.4	-73.0 2.4	-73.0 2.4	-73.0 2.4	-73.0 2.4	-73.0 2.4	-73.0 2.4	-73.0 2.4	-73.0 2.4	-73.0 2.4	-73.0 2.4	-90
Lat													Lat
E. Long	240	245	250	255	260	265	270	275	280	285	290	295	E. Long

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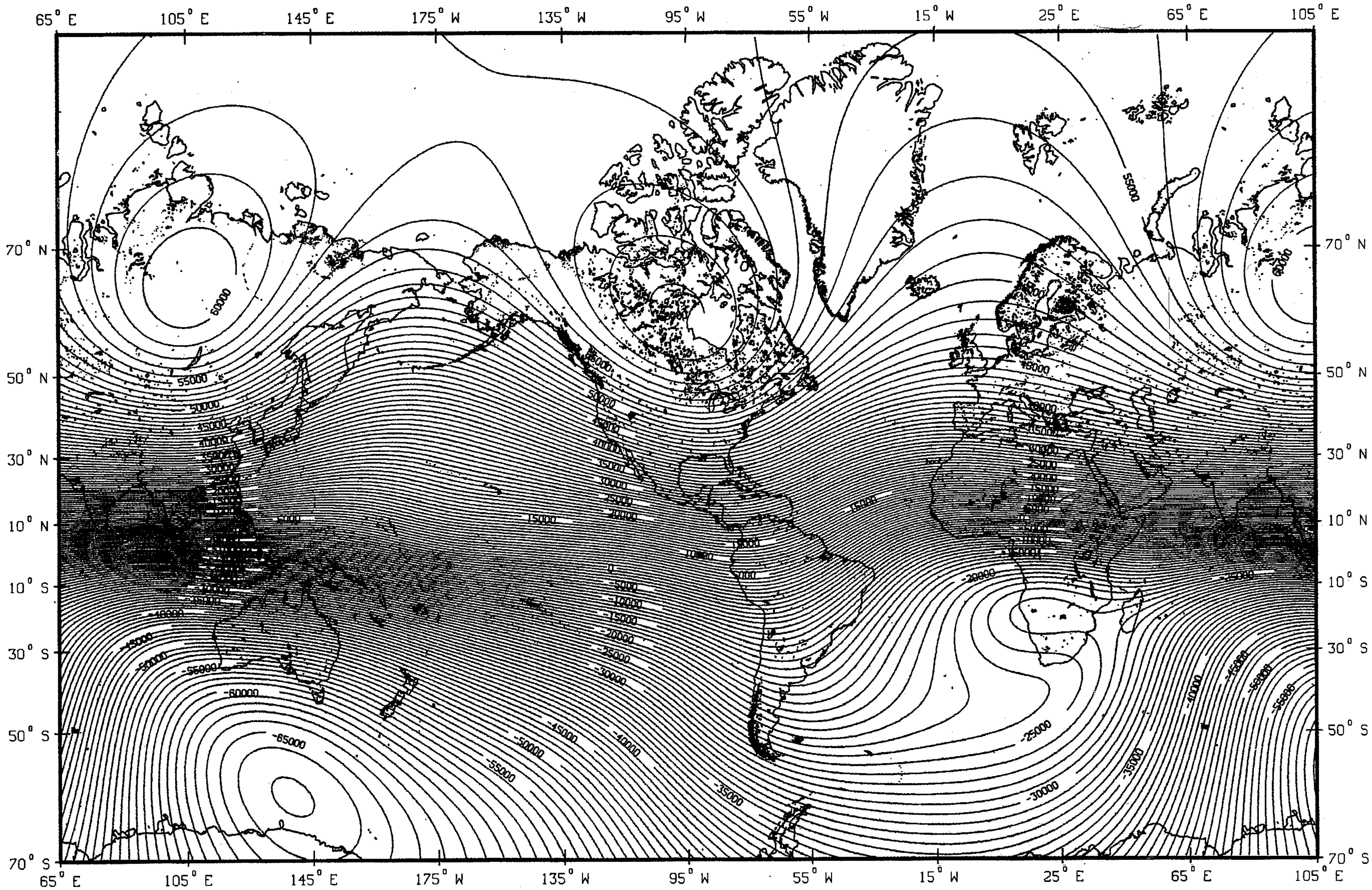
E. Long	300	305	310	315	320	325	330	335	340	345	350	355	E. Long
Lat													Lat
0	18.7	14.9	10.2	4.8	-1.1	-7.0	-12.5	-17.3	-21.1	-24.0	-25.9	-27.1	0
	-13.9	-17.9	-20.9	-22.6	-22.9	-22.0	-20.2	-17.7	-15.0	-12.3	-9.7	-7.4	
-5	10.1	6.2	1.4	-4.1	-10.1	-16.1	-21.6	-26.5	-30.5	-33.5	-35.7	-37.2	-5
	-13.3	-17.6	-20.9	-22.8	-23.2	-22.4	-20.6	-18.2	-15.7	-13.1	-10.6	-8.4	
-10	1.2	-2.7	-7.4	-12.8	-18.5	-24.2	-29.6	-34.3	-38.2	-41.3	-43.7	-45.5	-10
	-12.2	-16.5	-19.8	-21.8	-22.4	-21.7	-20.2	-18.2	-16.0	-13.7	-11.5	-9.5	
-15	-7.7	-11.3	-15.8	-20.8	-26.1	-31.3	-36.3	-40.6	-44.4	-47.5	-50.0	-52.0	-15
	-10.7	-14.7	-17.9	-19.9	-20.6	-20.3	-19.2	-17.7	-16.0	-14.1	-12.3	-10.5	
-20	-16.1	-19.3	-23.4	-27.9	-32.7	-37.3	-41.8	-45.7	-49.2	-52.2	-54.8	-56.9	-20
	-9.2	-12.7	-15.6	-17.5	-18.3	-18.4	-17.8	-16.8	-15.5	-14.2	-12.7	-11.1	
-25	-23.6	-26.4	-30.0	-34.0	-38.2	-42.3	-46.2	-49.8	-53.0	-55.8	-58.3	-60.4	-25
	-7.9	-10.9	-13.3	-15.0	-15.9	-16.2	-16.0	-15.4	-14.6	-13.7	-12.5	-11.1	
-30	-30.1	-32.5	-35.5	-39.0	-42.7	-46.3	-49.8	-52.9	-55.8	-58.4	-60.6	-62.6	-30
	-7.0	-9.3	-11.3	-12.8	-13.7	-14.1	-14.1	-13.8	-13.3	-12.5	-11.5	-10.2	
-35	-35.5	-37.4	-40.0	-43.0	-46.2	-49.3	-52.4	-55.2	-57.7	-60.0	-61.9	-63.6	-35
	-6.3	-8.2	-9.7	-10.9	-11.7	-12.0	-12.0	-11.8	-11.3	-10.6	-9.6	-8.4	
-40	-40.0	-41.5	-43.6	-46.0	-48.7	-51.5	-54.1	-56.5	-58.7	-60.6	-62.2	-63.5	-40
	-5.8	-7.2	-8.4	-9.2	-9.7	-9.9	-9.8	-9.4	-8.8	-8.0	-6.9	-5.6	
-45	-43.7	-44.8	-46.4	-48.4	-50.6	-52.8	-55.0	-57.0	-58.7	-60.3	-61.5	-62.5	-45
	-5.1	-6.2	-7.0	-7.5	-7.7	-7.6	-7.3	-6.7	-5.9	-4.8	-3.6	-2.3	
-50	-47.1	-47.9	-49.0	-50.4	-52.0	-53.7	-55.3	-56.9	-58.2	-59.4	-60.3	-61.0	-50
	-4.2	-4.9	-5.4	-5.6	-5.6	-5.2	-4.6	-3.8	-2.8	-1.7	-0.4	0.8	
-55	-50.4	-50.8	-51.5	-52.4	-53.5	-54.6	-55.8	-56.8	-57.8	-58.6	-59.2	-59.7	-55
	-3.0	-3.5	-3.7	-3.7	-3.5	-3.0	-2.2	-1.3	-0.3	0.8	1.9	3.0	
-60	-53.8	-53.9	-54.2	-54.7	-55.3	-56.0	-56.7	-57.3	-57.9	-58.5	-58.9	-59.2	-60
	-1.8	-2.0	-2.1	-1.9	-1.6	-1.0	-0.3	0.5	1.4	2.3	3.2	4.0	
-65	-57.2	-57.1	-57.2	-57.4	-57.6	-57.9	-58.3	-58.6	-59.0	-59.3	-59.5	-59.8	-65
	-0.5	-0.6	-0.6	-0.4	-0.1	0.4	1.0	1.6	2.3	2.9	3.6	4.1	
-70	-60.7	-60.5	-60.4	-60.4	-60.4	-60.4	-60.6	-60.7	-60.8	-61.0	-61.2	-61.3	-70
	0.5	0.5	0.6	0.8	1.0	1.3	1.7	2.2	2.6	3.0	3.4	3.8	
-75	-64.2	-63.9	-63.7	-63.5	-63.4	-63.3	-63.3	-63.3	-63.4	-63.4	-63.5	-63.6	-75
	1.3	1.4	1.5	1.6	1.8	2.0	2.2	2.4	2.7	2.9	3.1	3.3	
-80	-67.4	-67.1	-66.9	-66.7	-66.6	-66.5	-66.4	-66.3	-66.3	-66.3	-66.4	-66.4	-80
	1.9	2.0	2.0	2.1	2.2	2.3	2.4	2.5	2.6	2.8	2.9	3.0	
-85	-70.3	-70.2	-70.0	-69.9	-69.8	-69.7	-69.6	-69.6	-69.6	-69.6	-69.6	-69.6	-85
	2.3	2.3	2.3	2.4	2.4	2.4	2.5	2.5	2.6	2.6	2.6	2.7	
-90	-73.0	-73.0	-73.0	-73.0	-73.0	-73.0	-73.0	-73.0	-73.0	-73.0	-73.0	-73.0	-90
	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	
Lat													Lat
E. Long	300	305	310	315	320	325	330	335	340	345	350	355	E. Long



1995.0 at surface of WGS-84 reference ellipsoid.

units: nT

Chart 64. Vertical Component (Z)

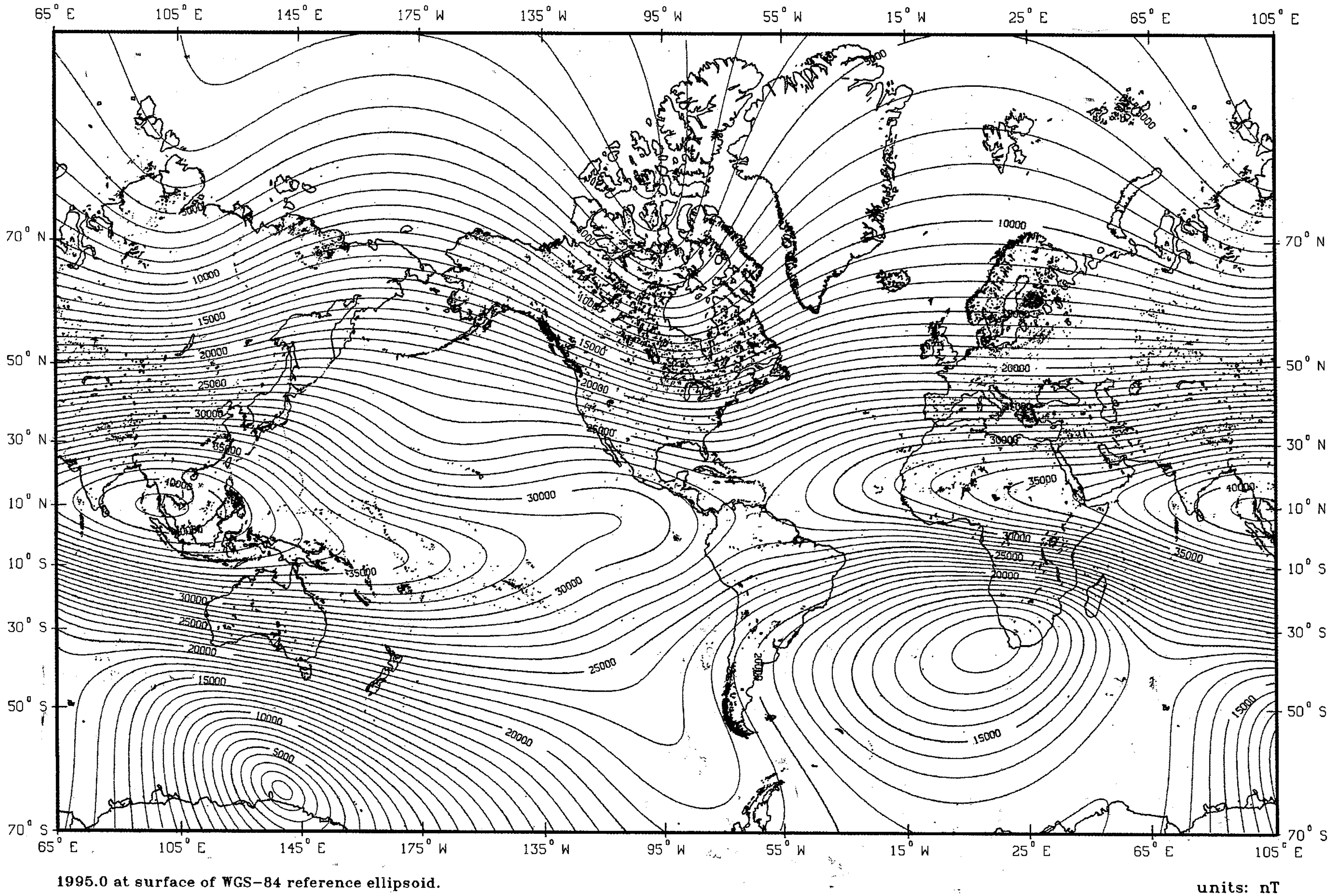
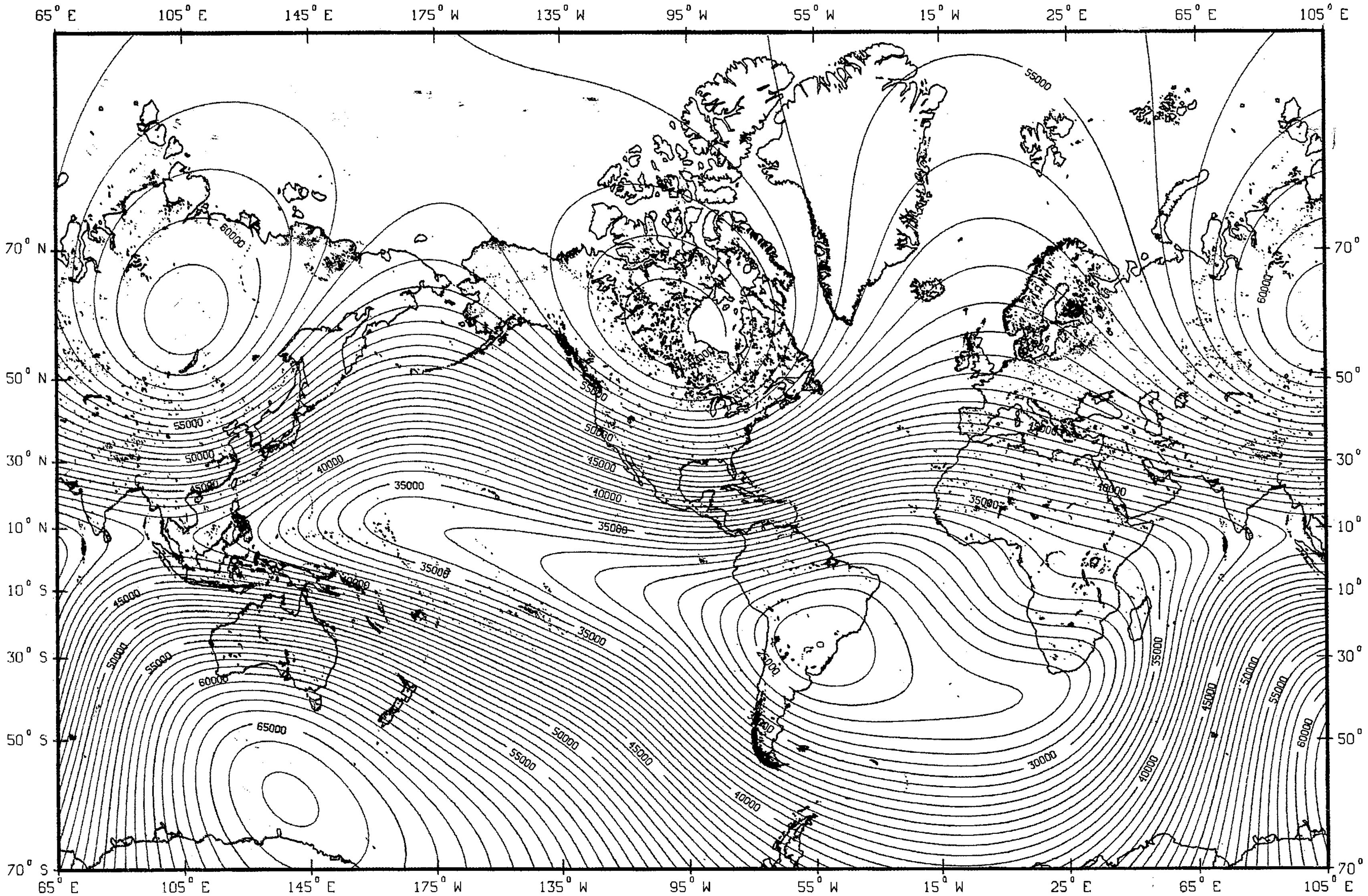


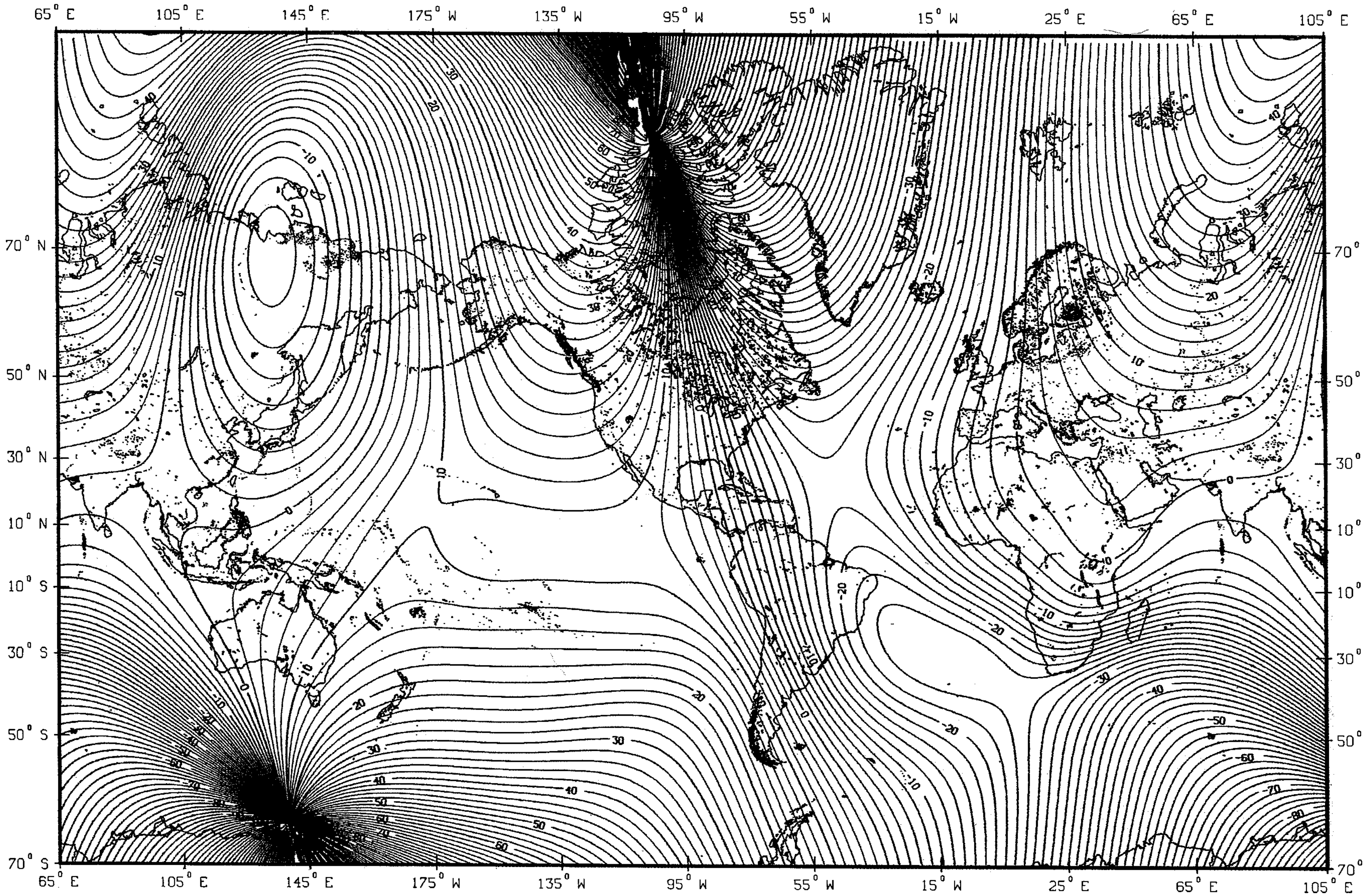
Chart 65. Horizontal Intensity (H)



1995.0 at surface of WGS-84 reference ellipsoid.

units: nT

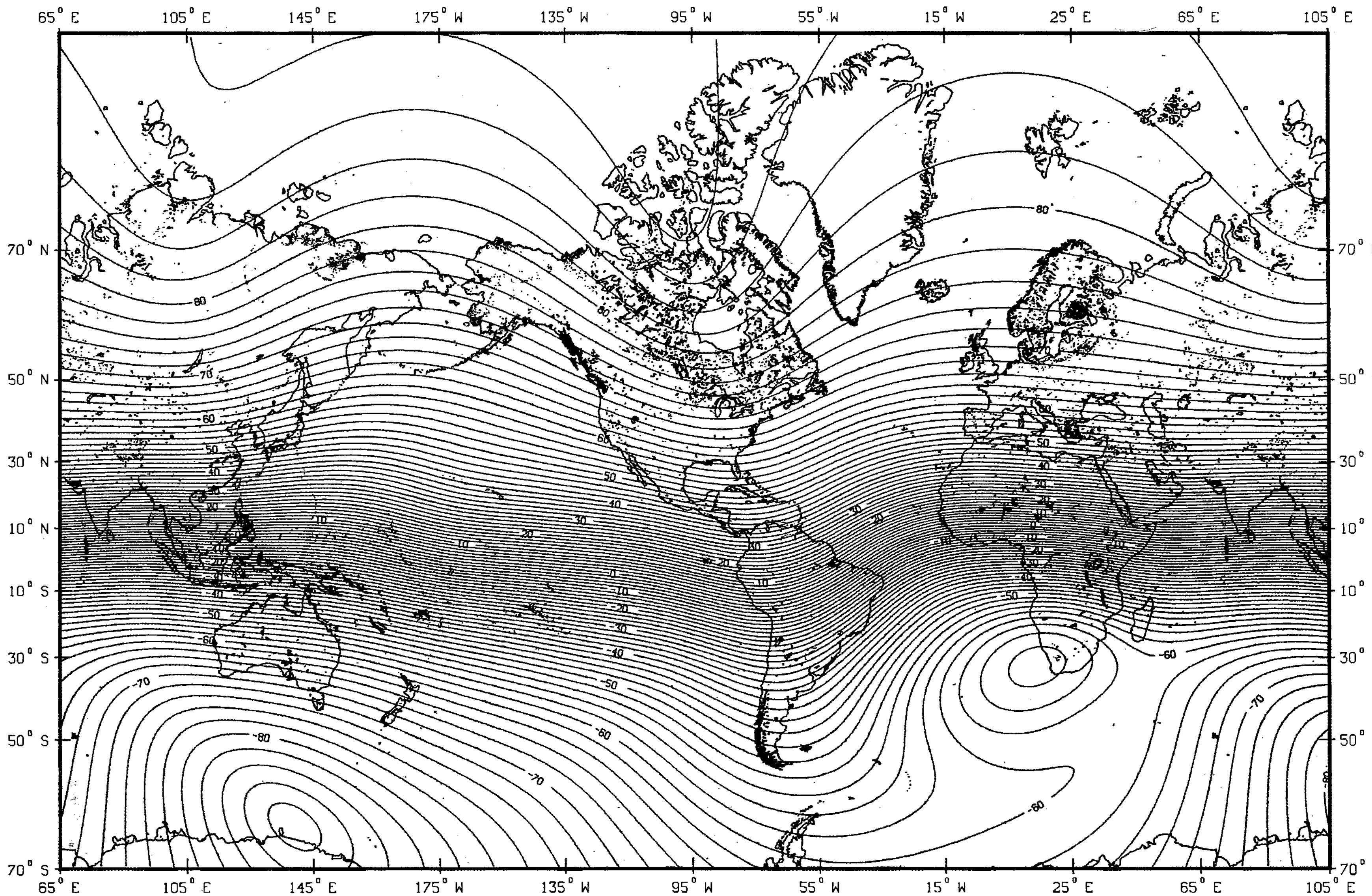
Chart 66. Total Intensity (F)



1995.0 at surface of WGS-84 reference ellipsoid.

units: degrees

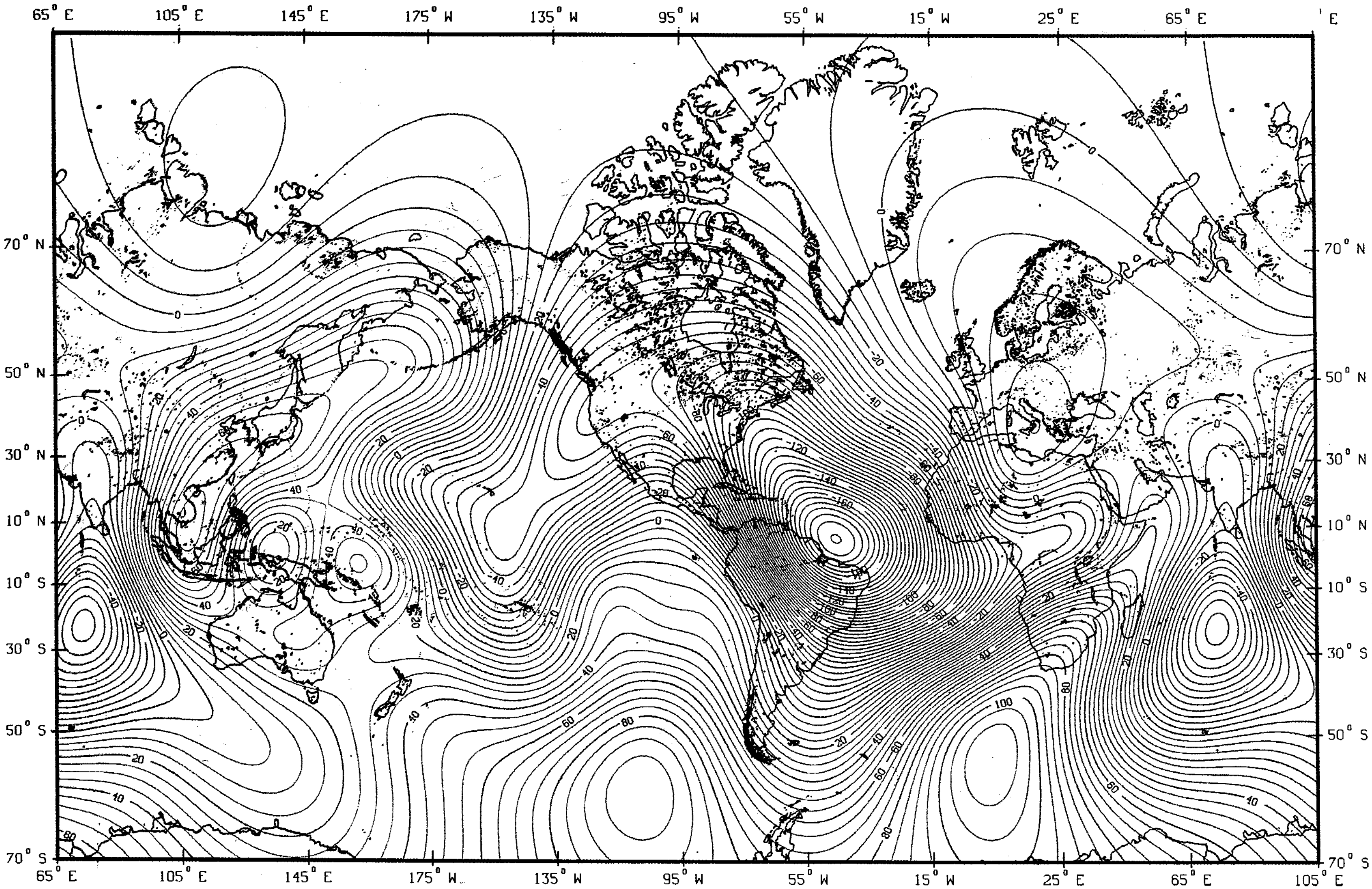
Chart 67. Declination (D)



1995.0 at surface of WGS-84 reference ellipsoid.

units: degrees

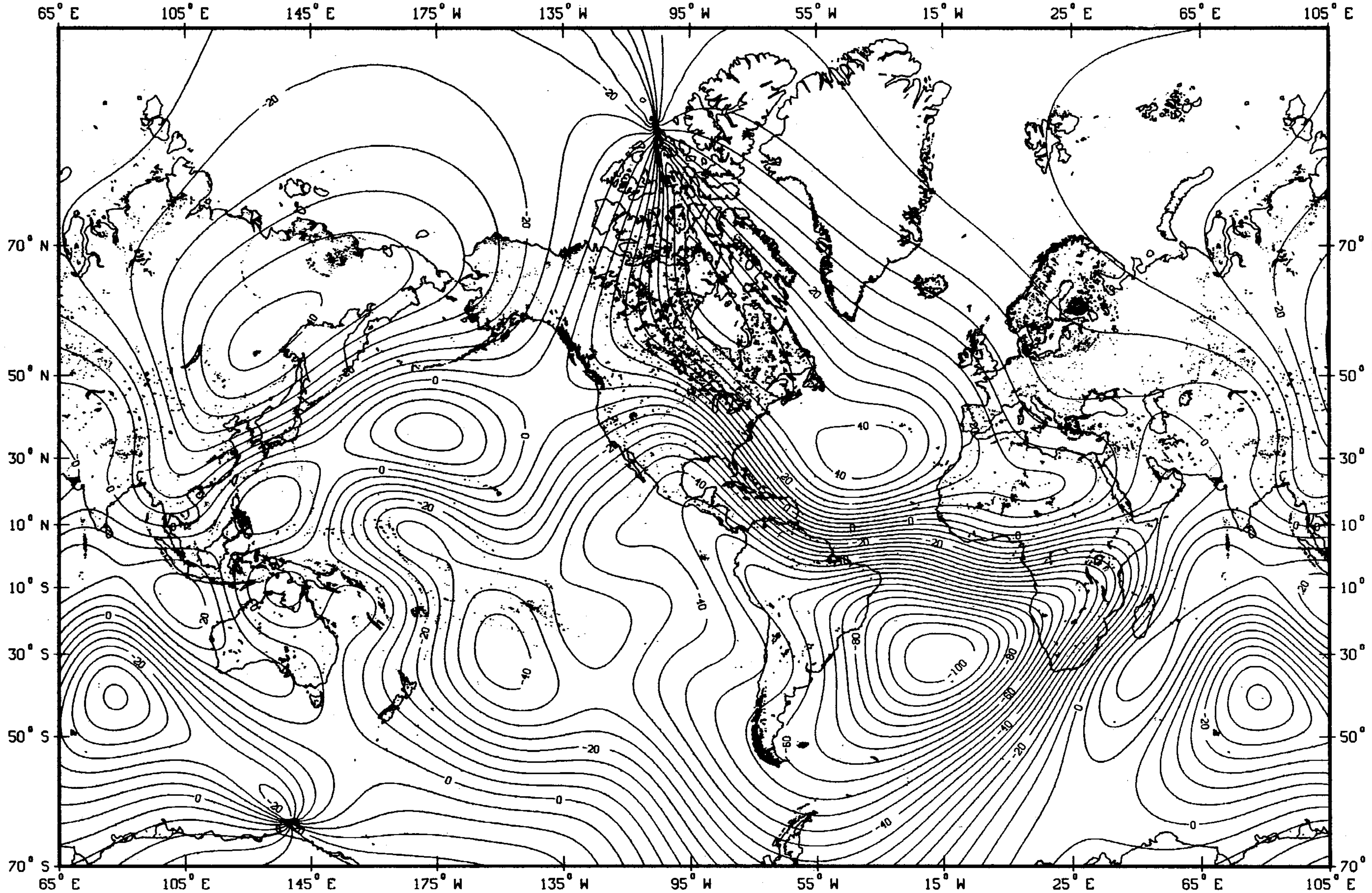
Chart 68. Inclination (I)



1997.5 at surface of WGS–84 reference ellipsoid.

units: nT/yr

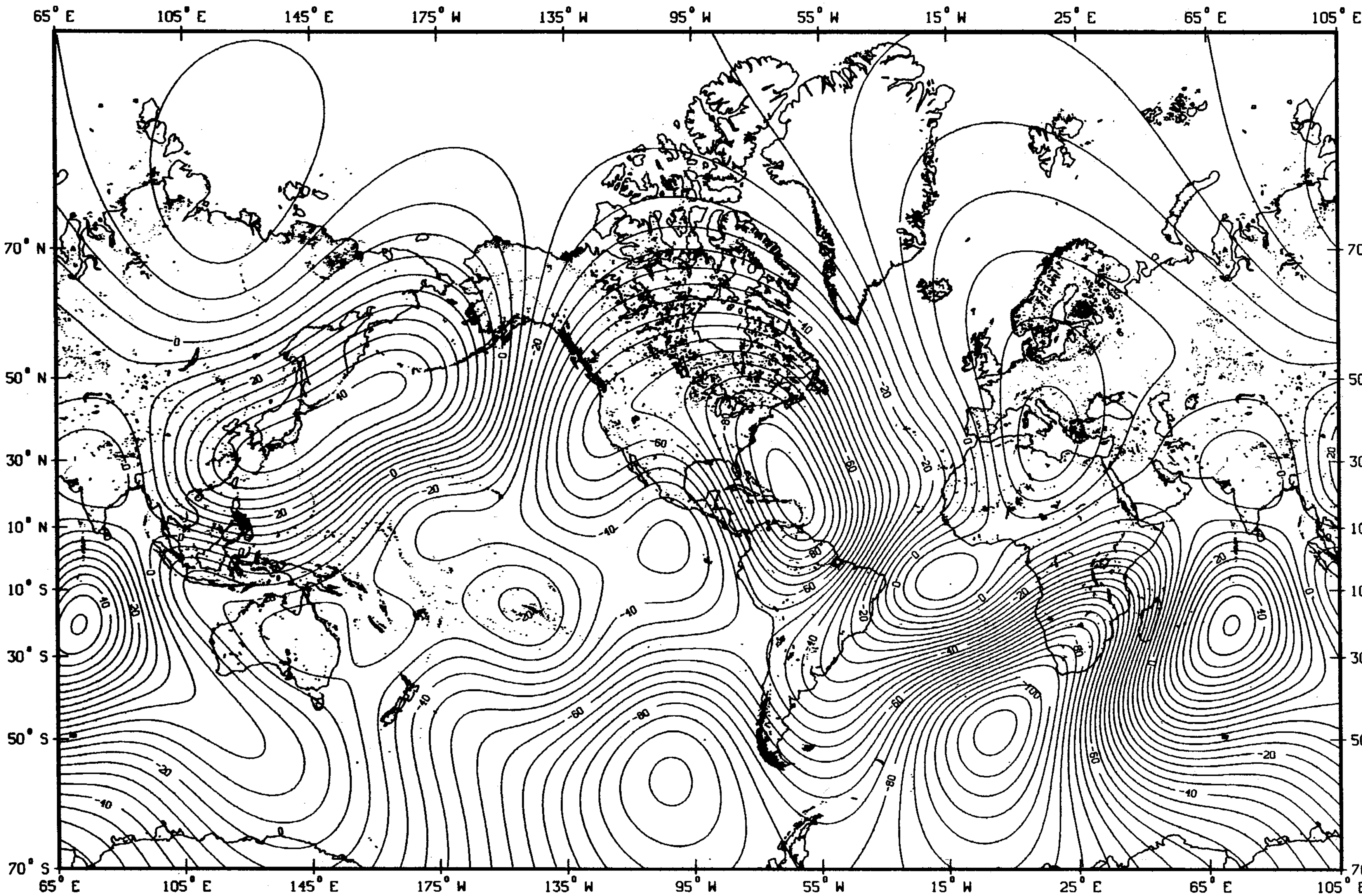
Chart 69. Vertical Component ($\dot{Z}$)



1997.5 at surface of WGS-84 reference ellipsoid.

units: nT/yr

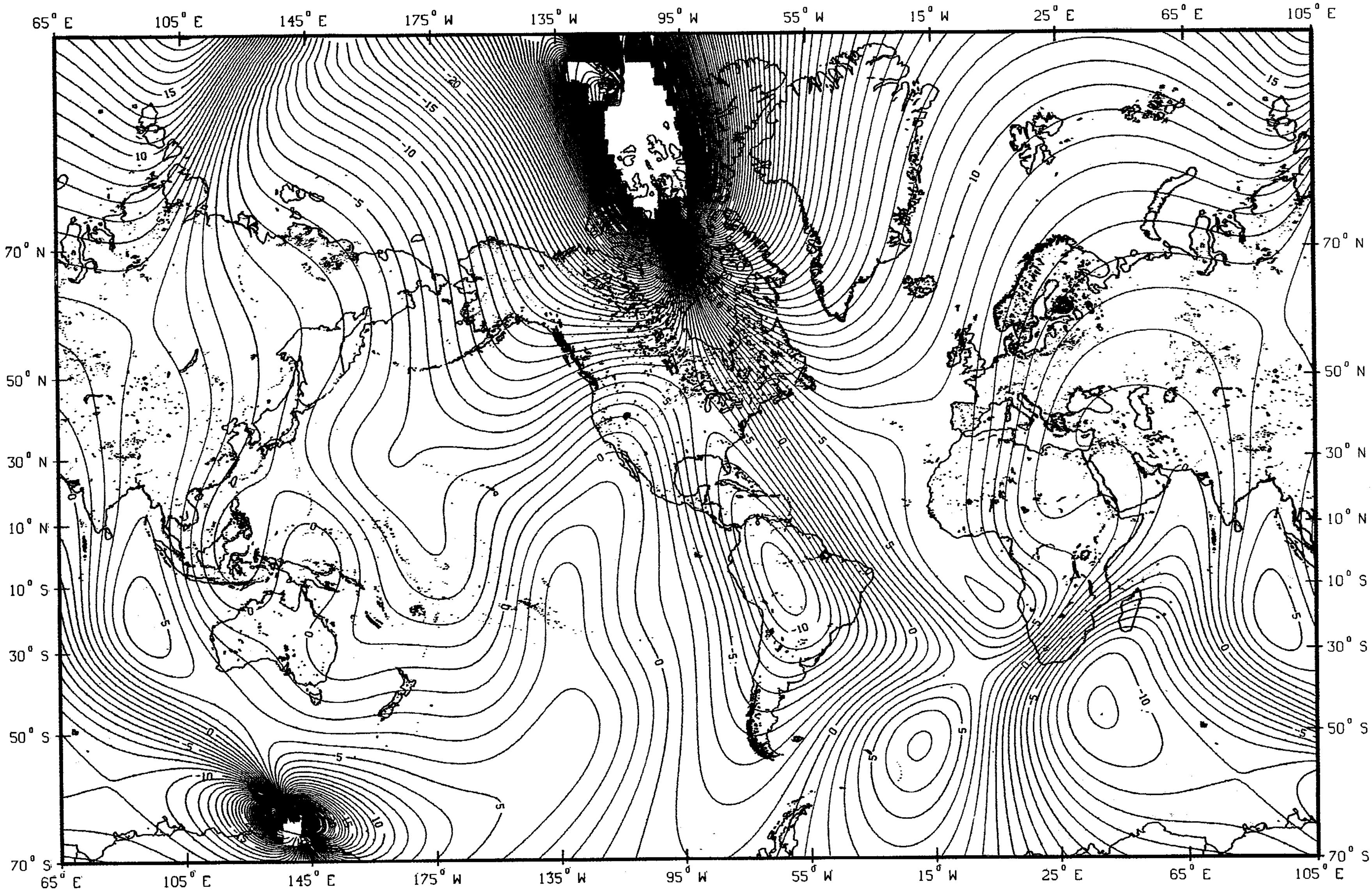
Chart 70. Horizontal Intensity ($\dot{H}$)



1997.5 at surface of WGS-84 reference ellipsoid.

units: nT/yr

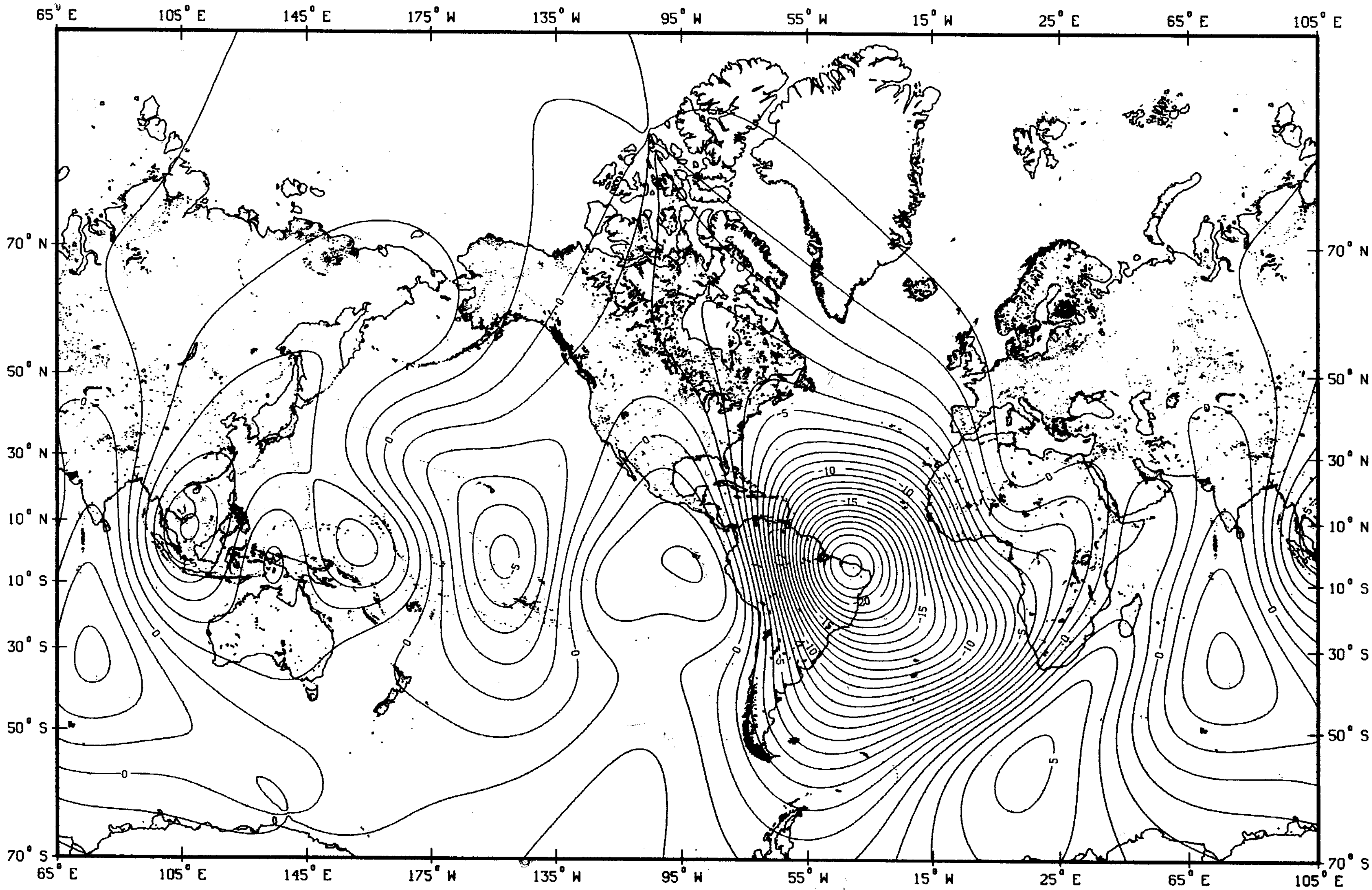
Chart 71. Total Intensity ($\dot{F}$)



1997.5 at surface of WGS–84 reference ellipsoid.

units: minutes/yr

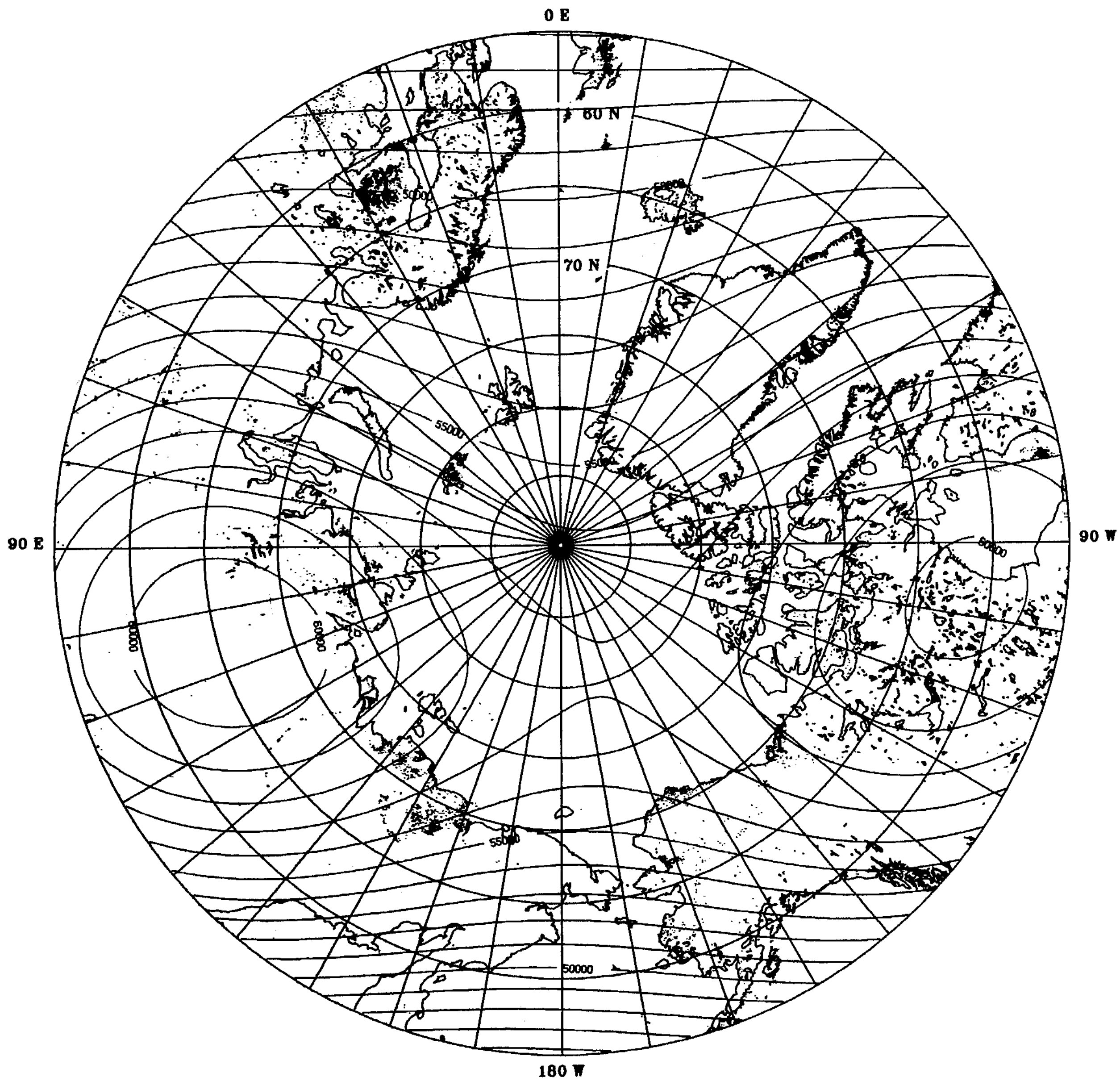
Chart 72. Declination ($\dot{D}$)



1997.5 at surface of WGS-84 reference ellipsoid.

units: degrees

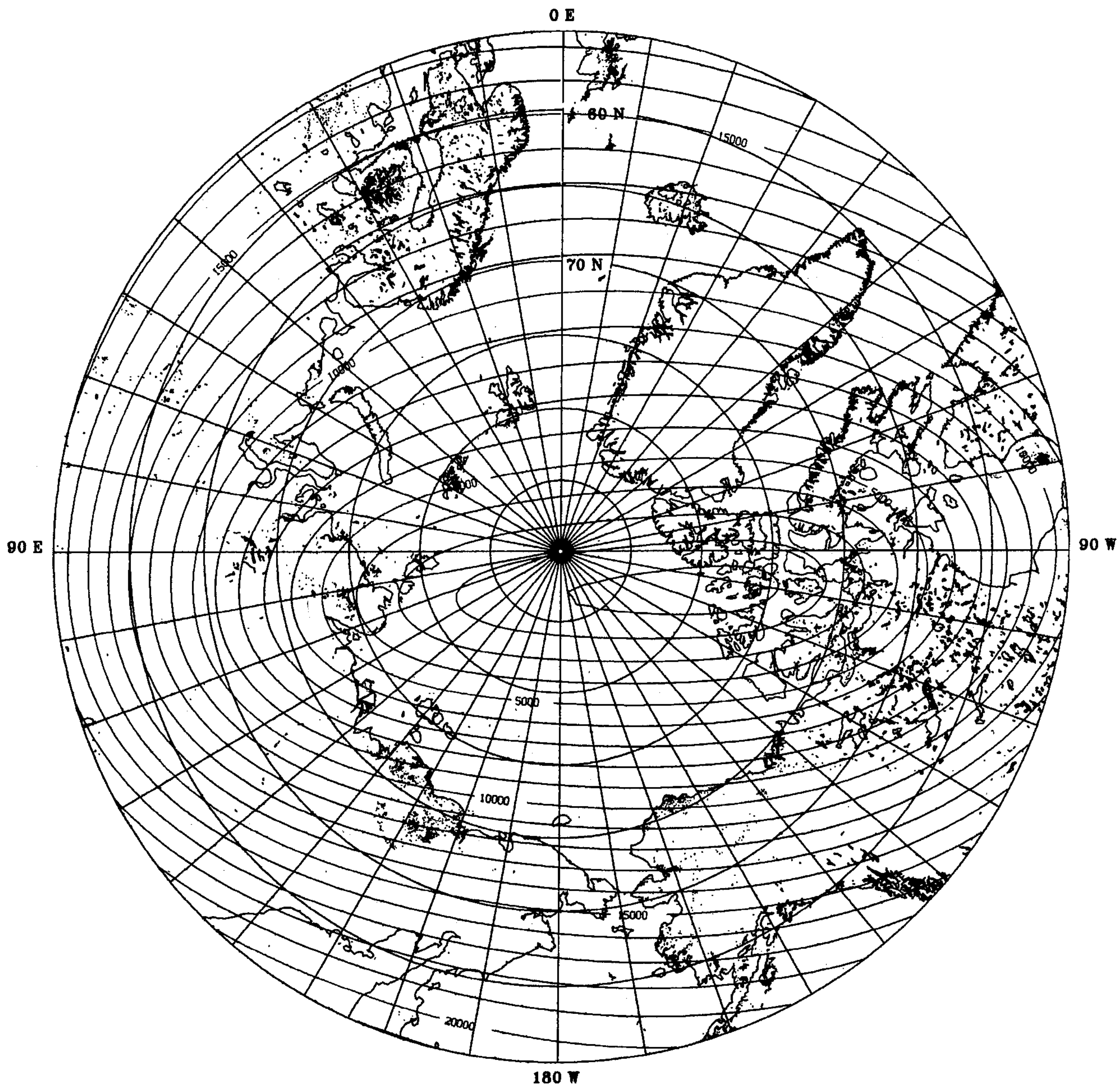
Chart 73. Inclination (I)



1995.0 at surface of WGS-84 reference ellipsoid.

units: nT

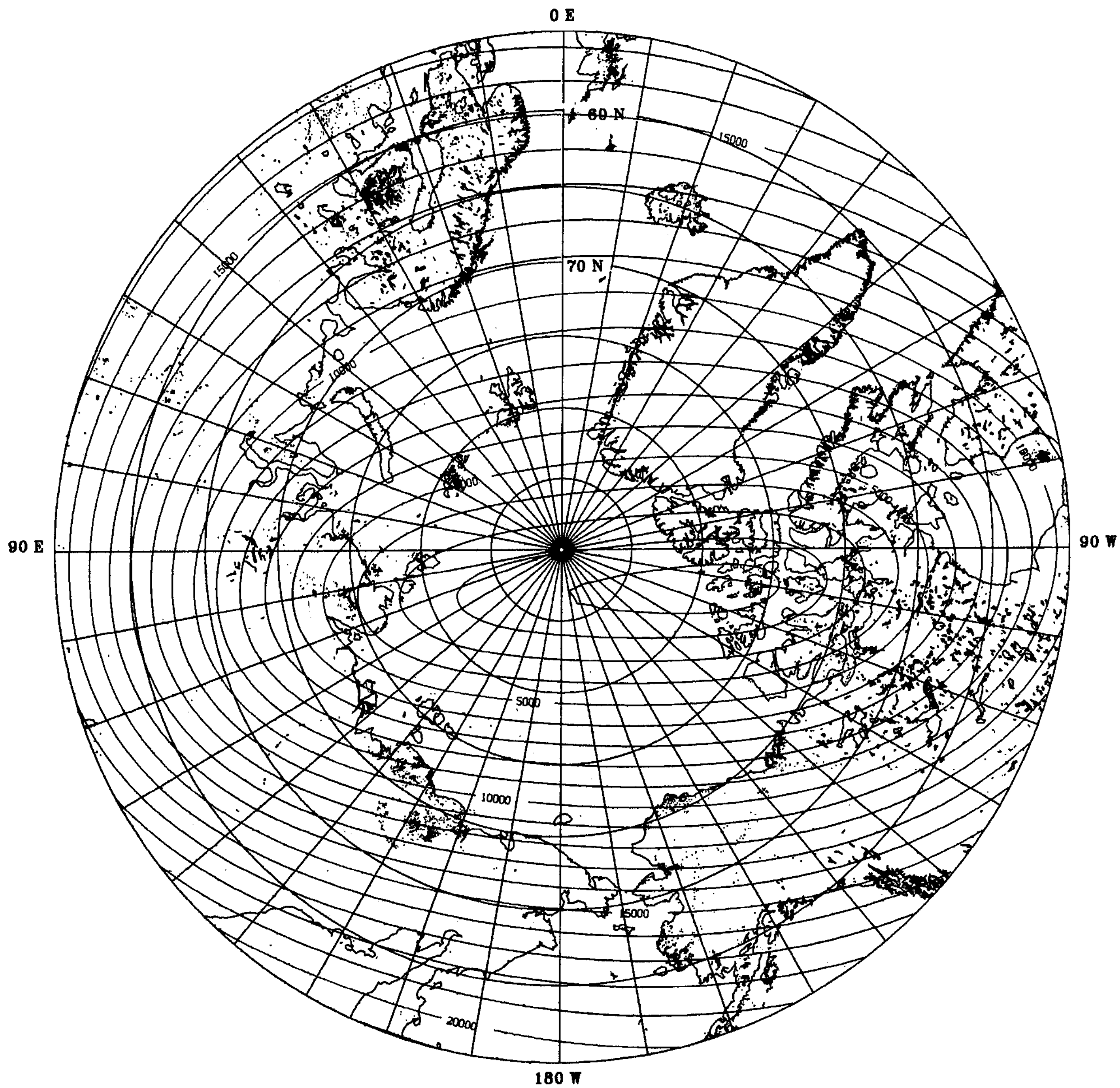
Chart 74. Vertical Component (Z)



1995.0 at surface of WGS-84 reference ellipsoid.

units: nT

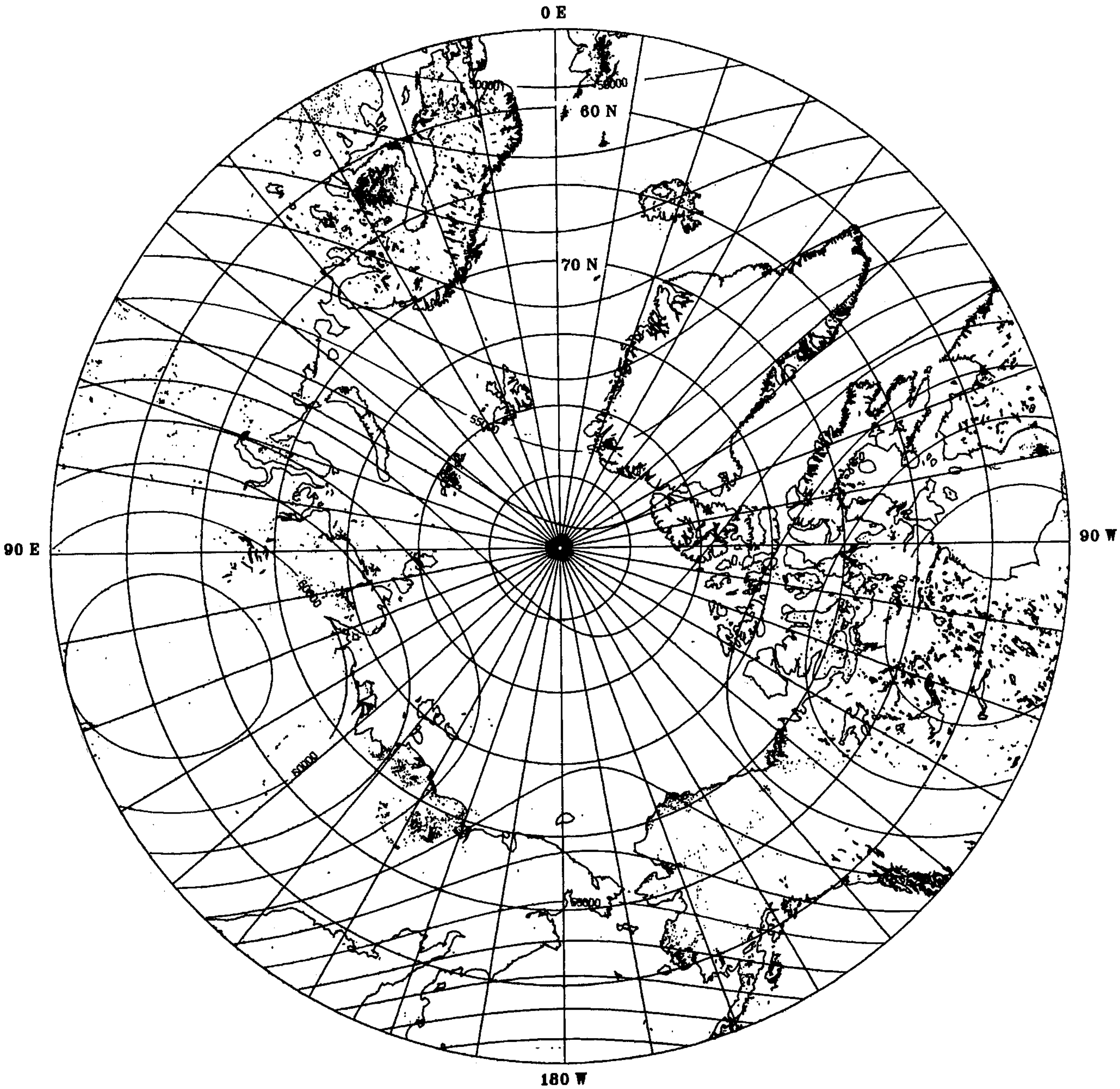
Chart 75. Horizontal Intensity (H)



1995.0 at surface of WGS−84 reference ellipsoid.

units: nT

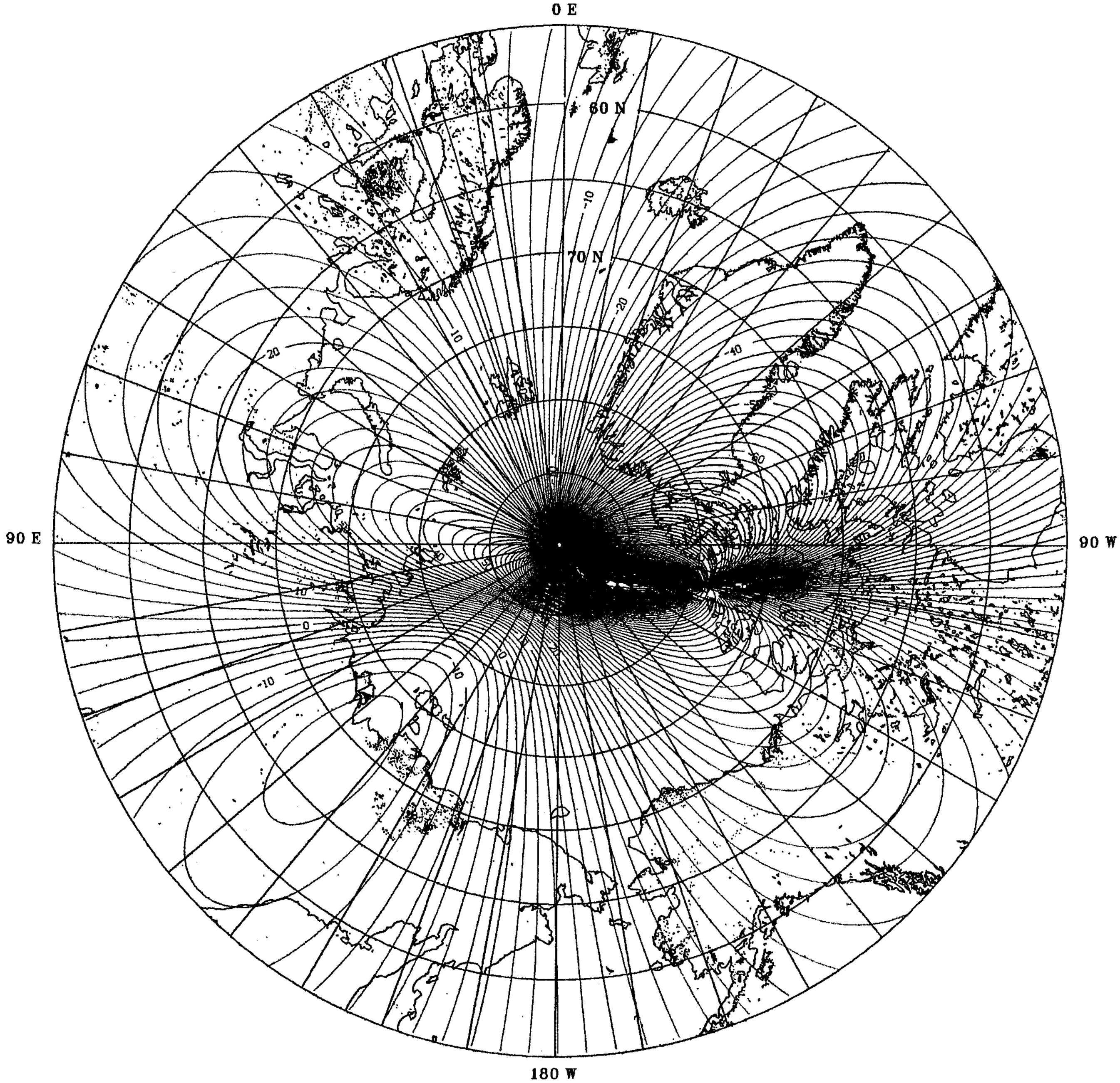
Chart 75. Horizontal Intensity (H)



1995.0 at surface of WGS-84 reference ellipsoid.

units: nT

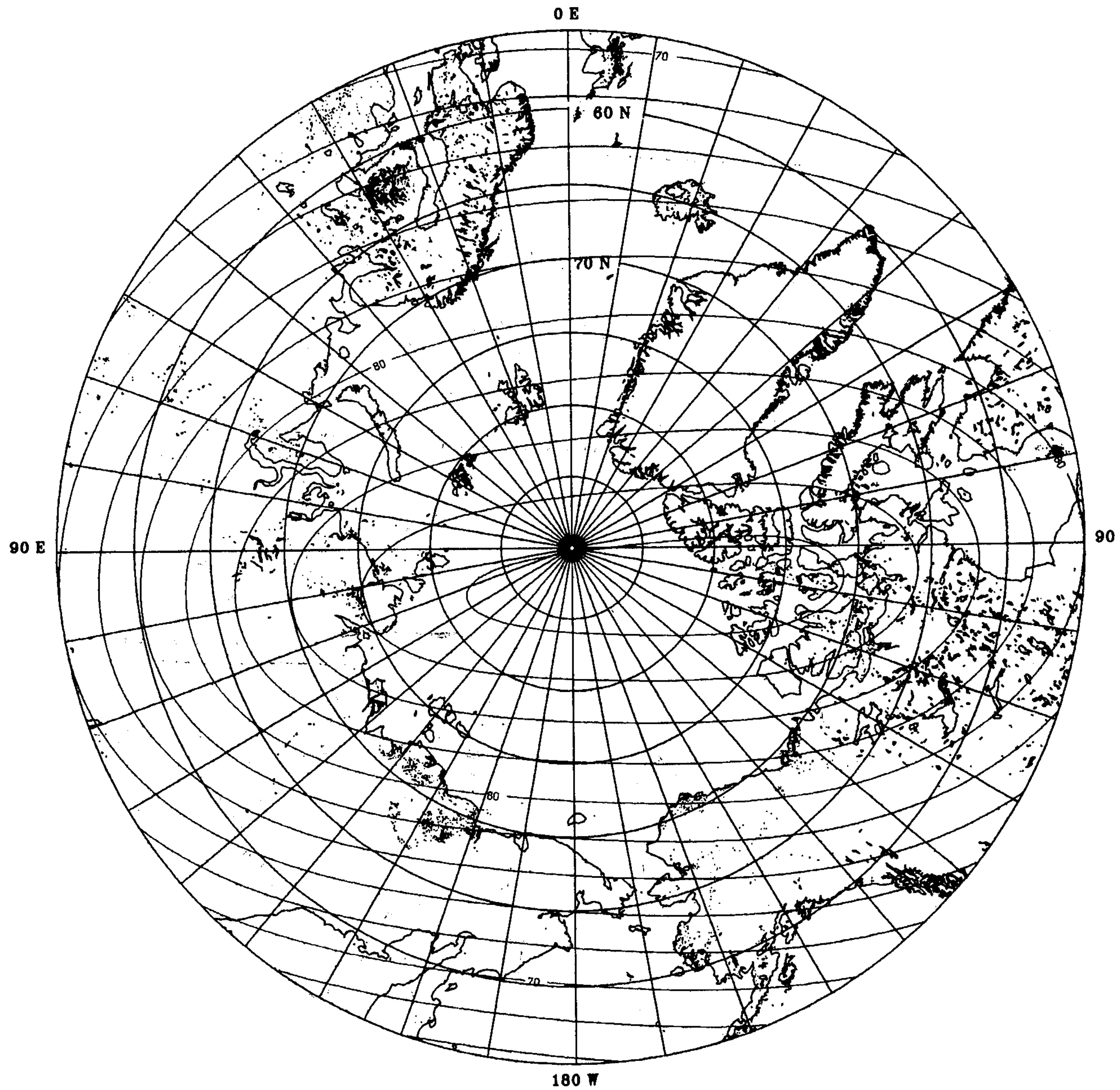
Chart 76. Total Intensity (F)



1995.0 at surface of WGS-84 reference ellipsoid.

units: degrees

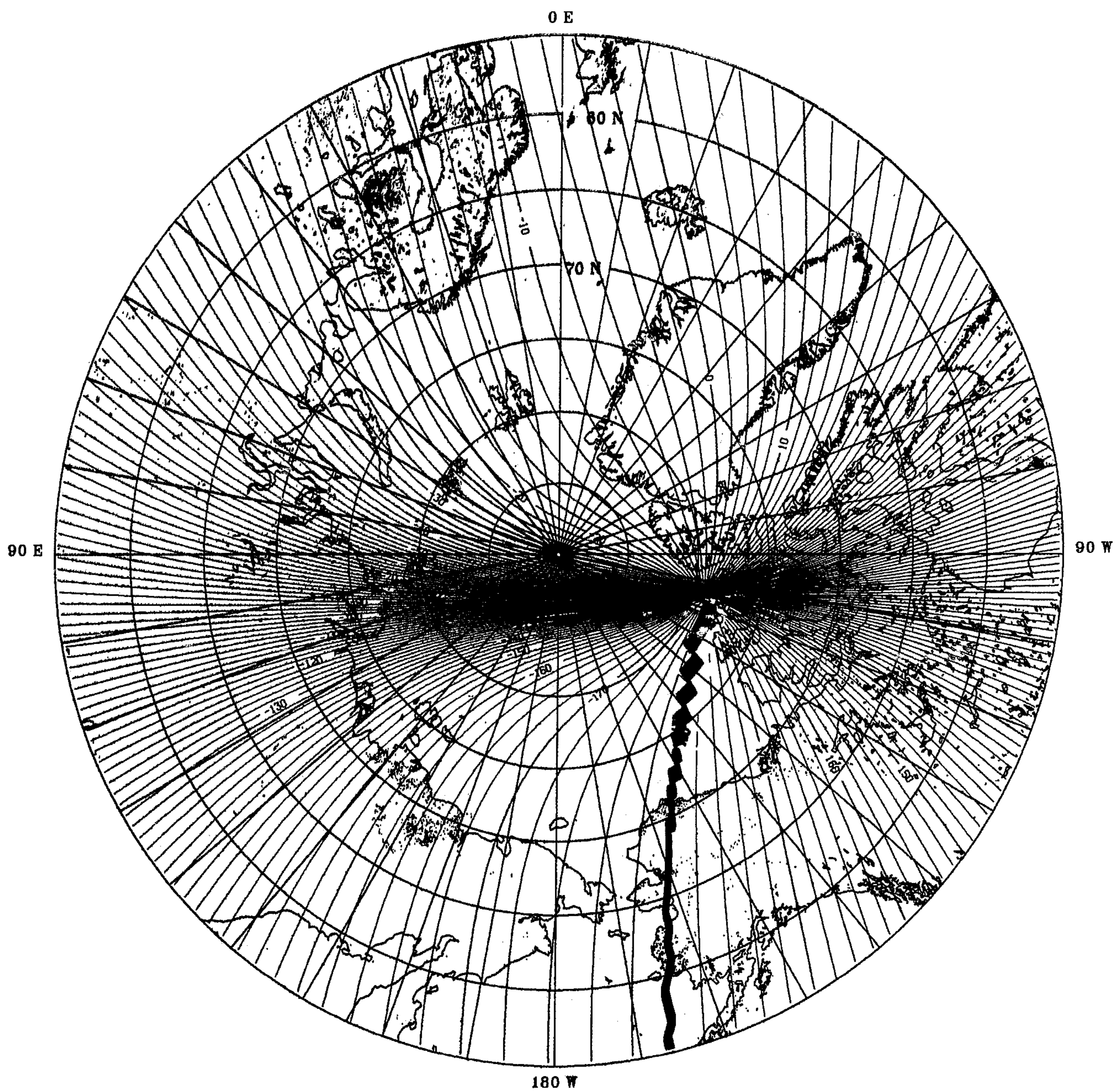
Chart 77. Declination (D)



1995.0 at surface of WGS-84 reference ellipsoid.

units: degrees

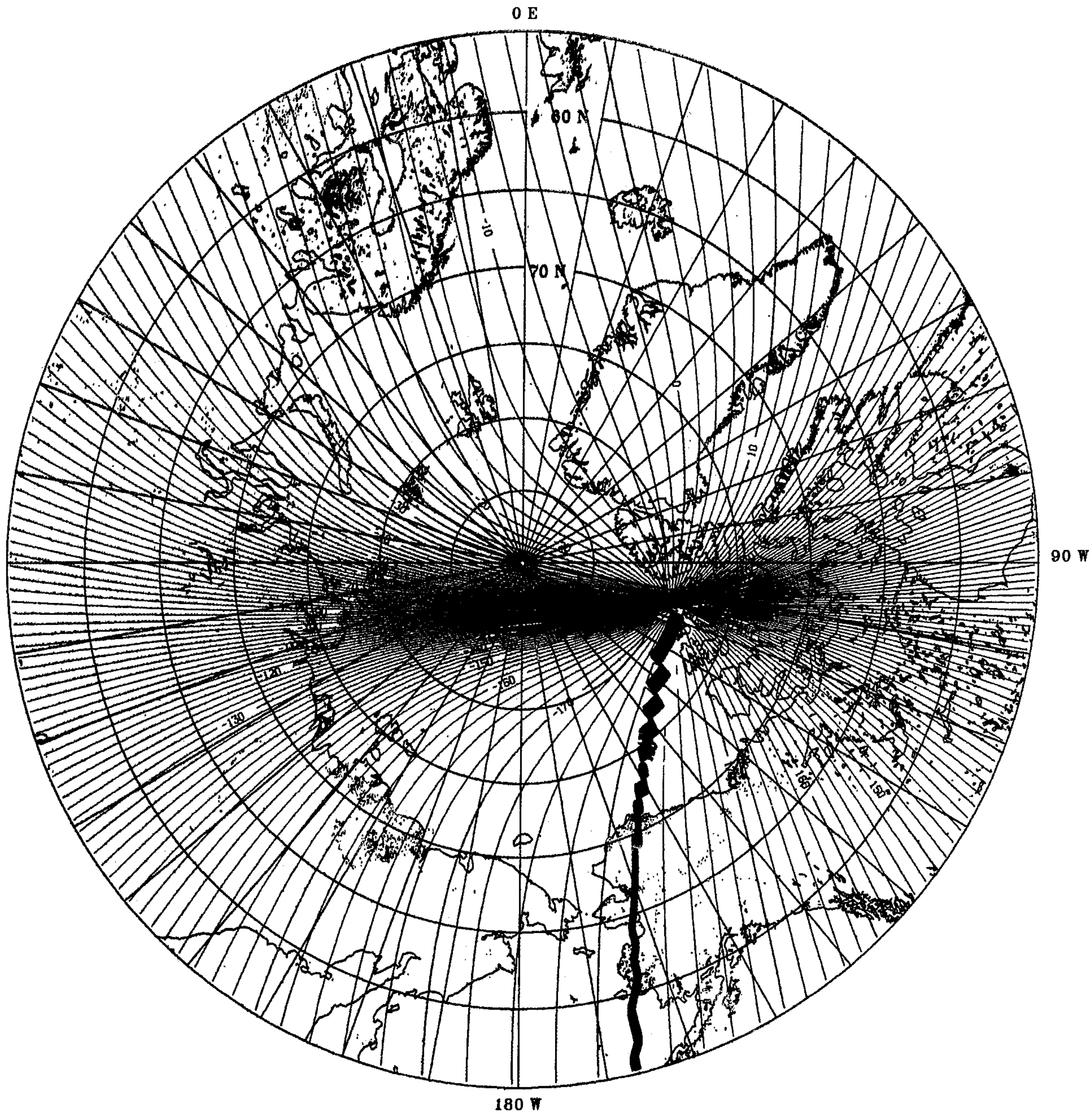
Chart 78. Inclination (I)



1995.0 at surface of WGS−84 reference ellipsoid.

units: degrees

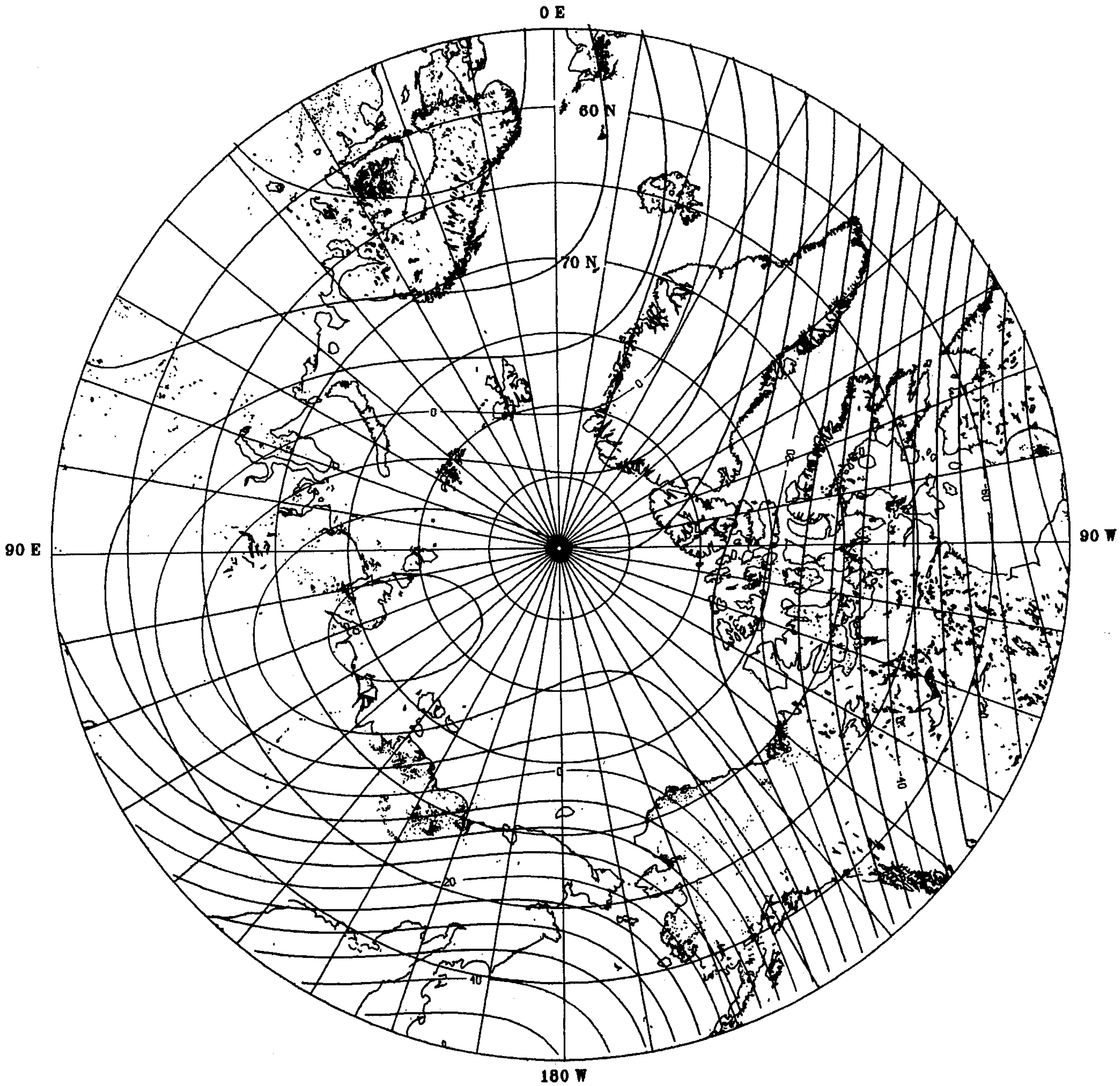
Chart 79. Grid Variation (GV)



1995.0 at surface of WGS-84 reference ellipsoid.

units: degrees

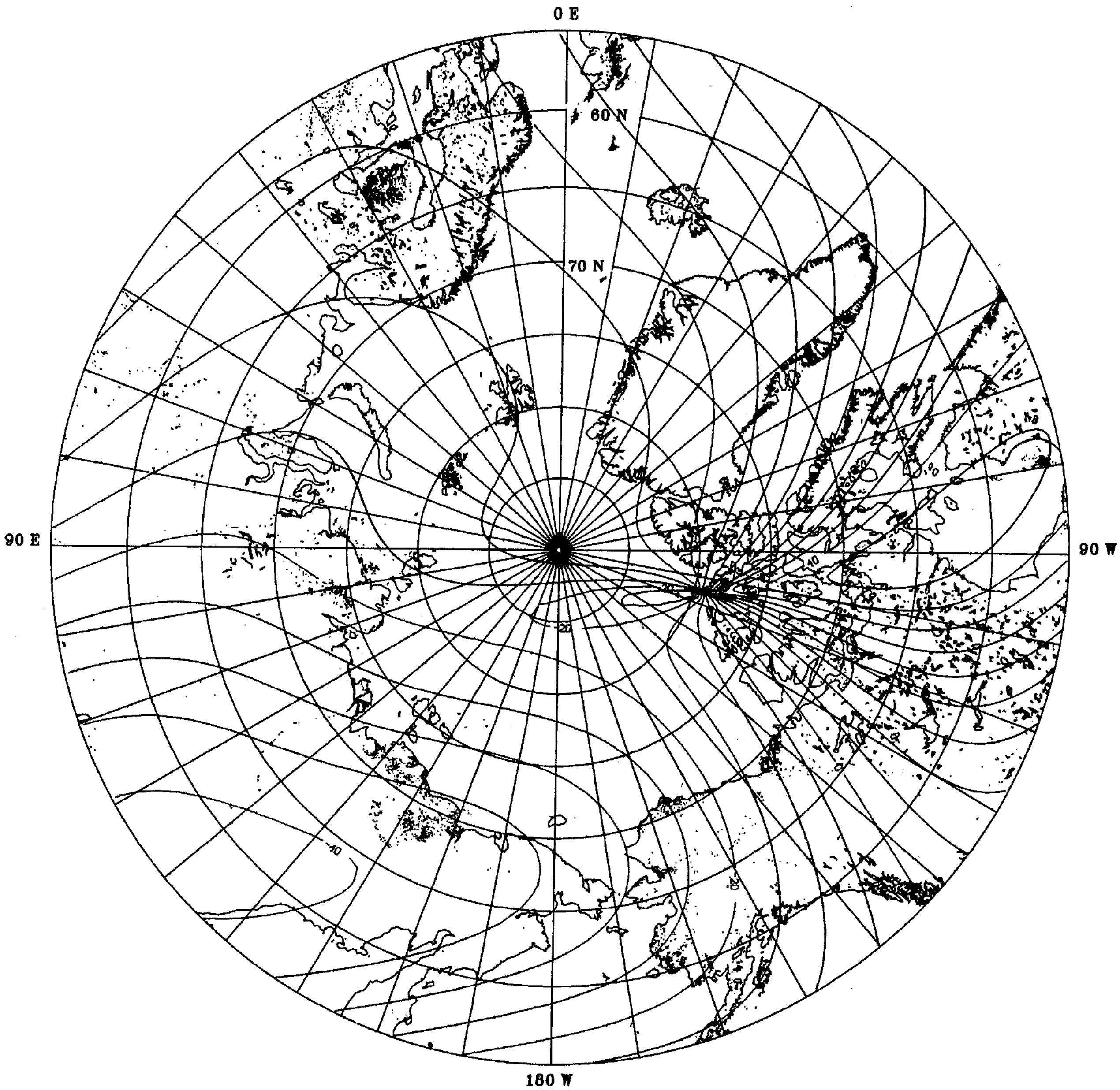
Chart 79. Grid Variation (GV)



1997.5 at surface of WGS-84 reference ellipsoid.

units: nT/yr

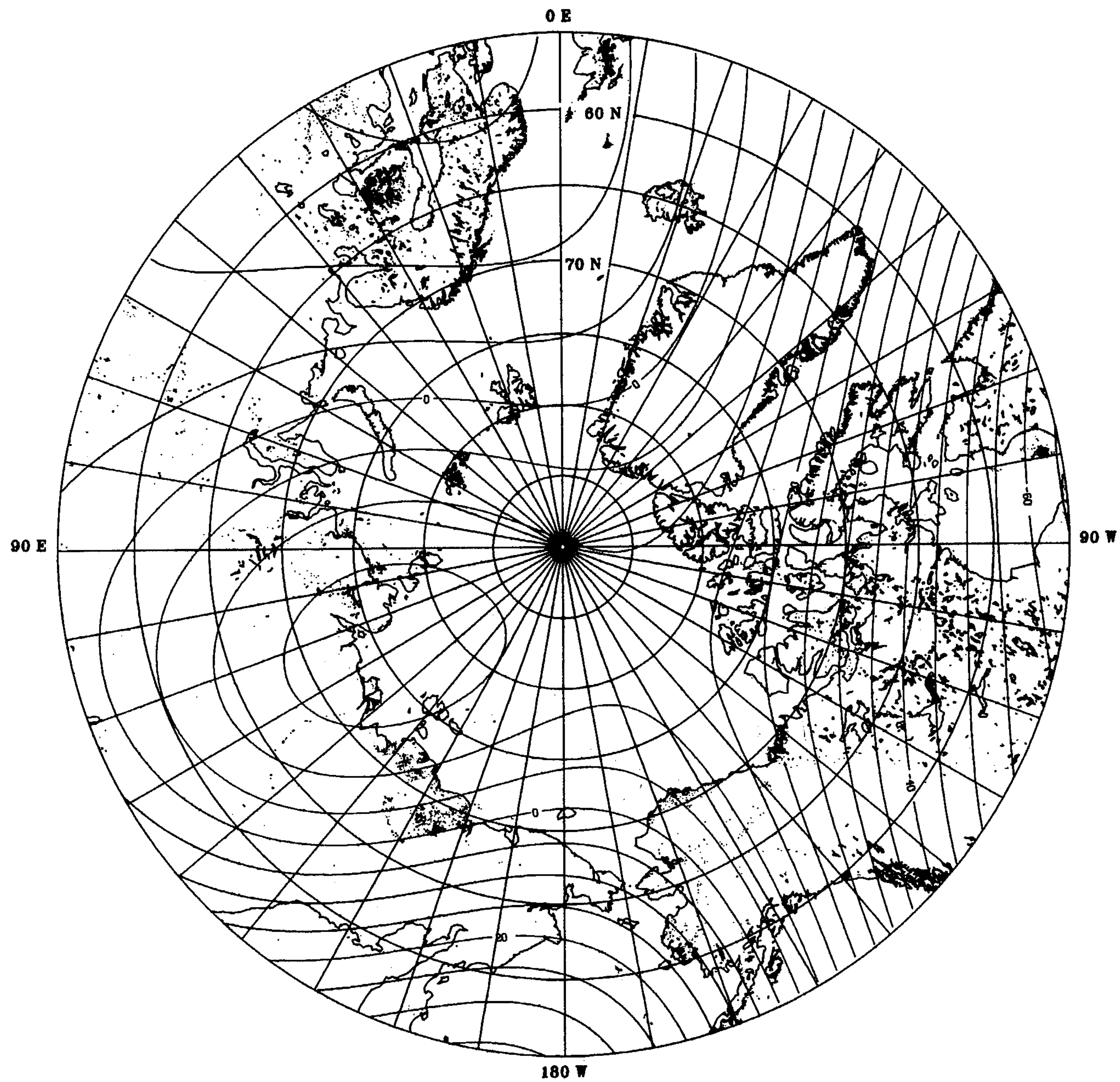
Chart 80. Vertical Component ($\dot{Z}$)



1997.5 at surface of WGS-84 reference ellipsoid.

units: nT/yr

Chart 81. Horizontal Intensity ($\dot{H}$)



1997.5 at surface of WGS-84 reference ellipsoid.

units: nT/yr

Chart 82. Total Intensity ($\dot{F}$)

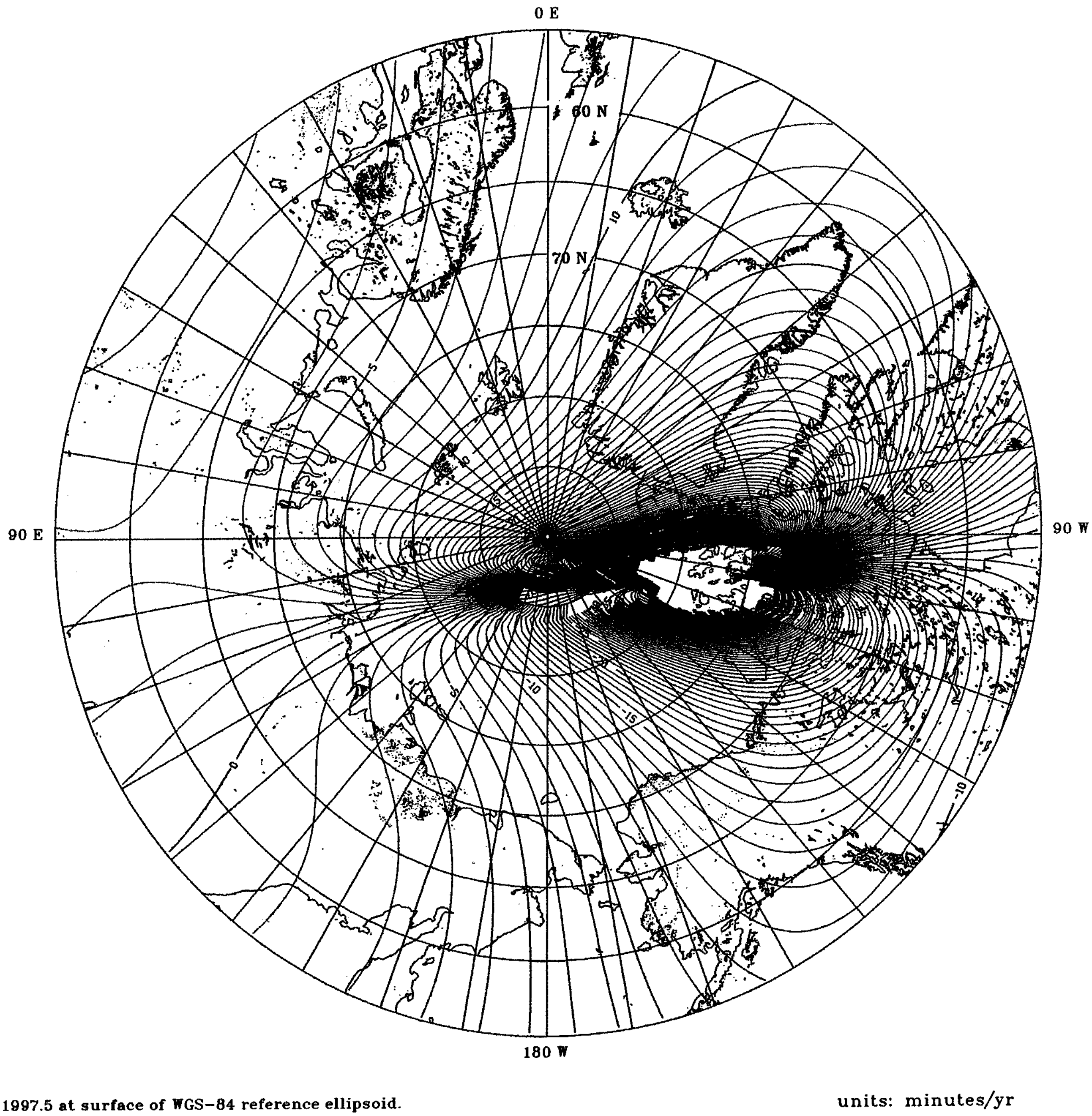
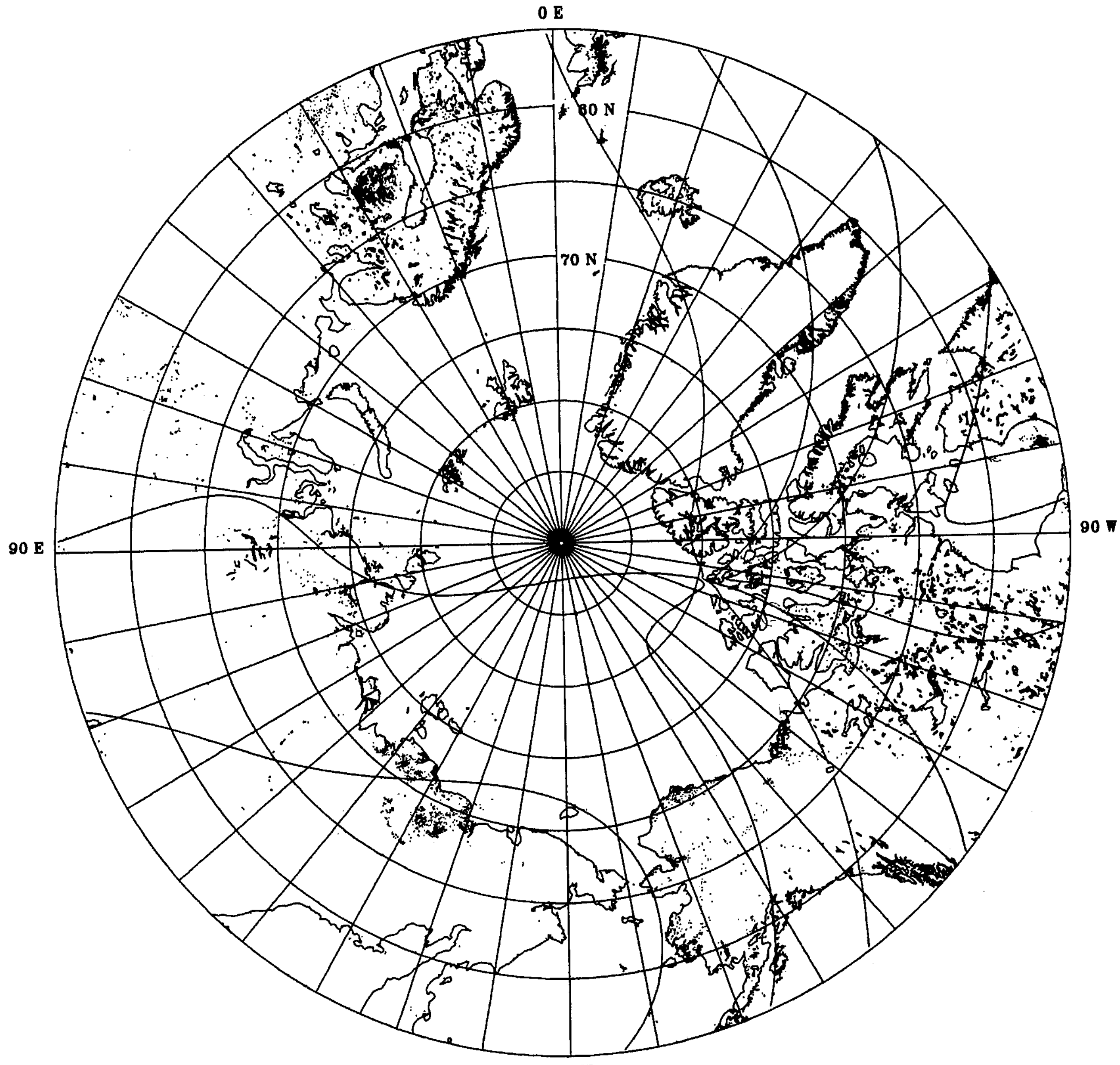


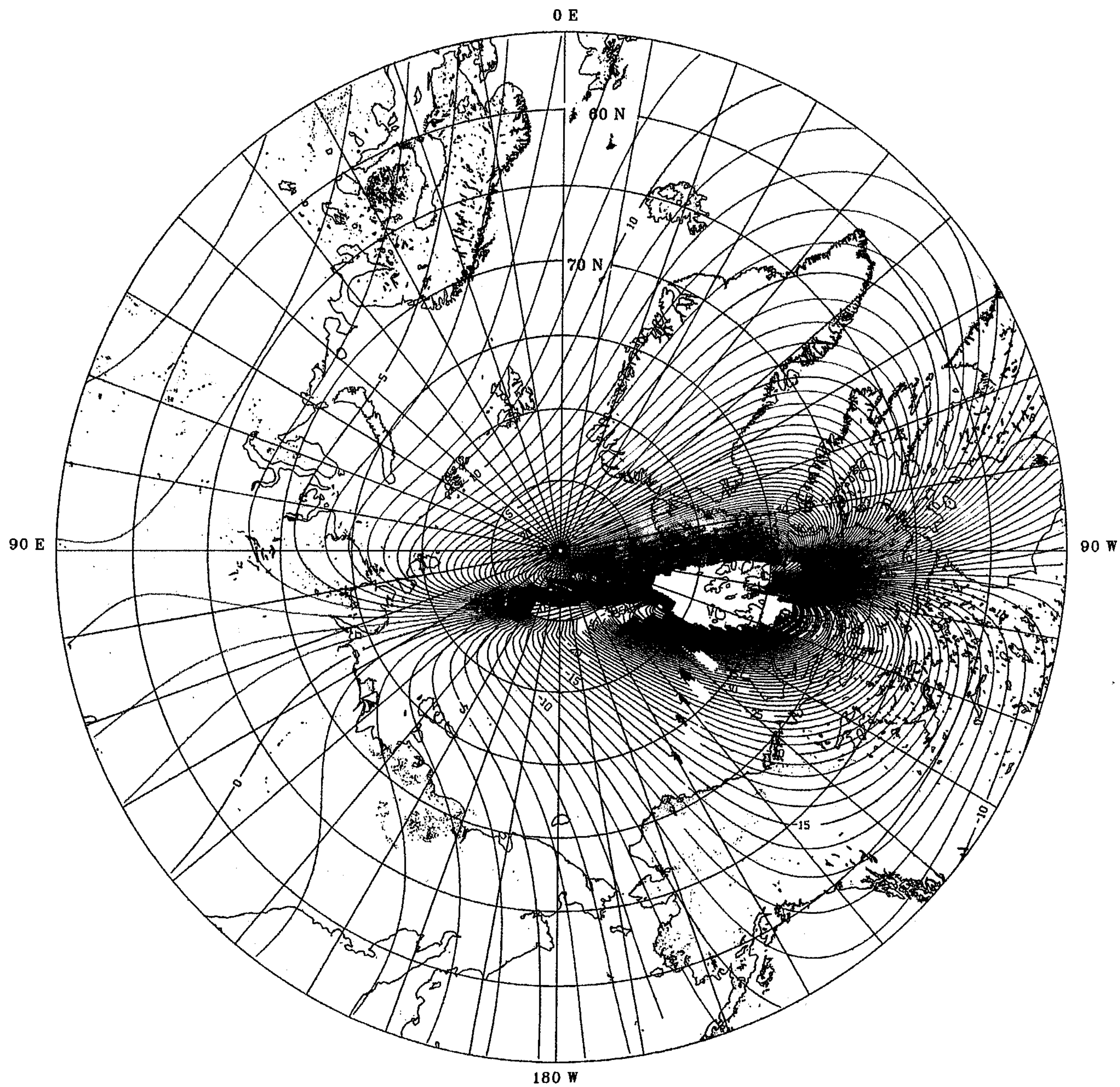
Chart 83. Declination ($\dot{D}$)



1997.5 at surface of WGS-84 reference ellipsoid.

units: degrees

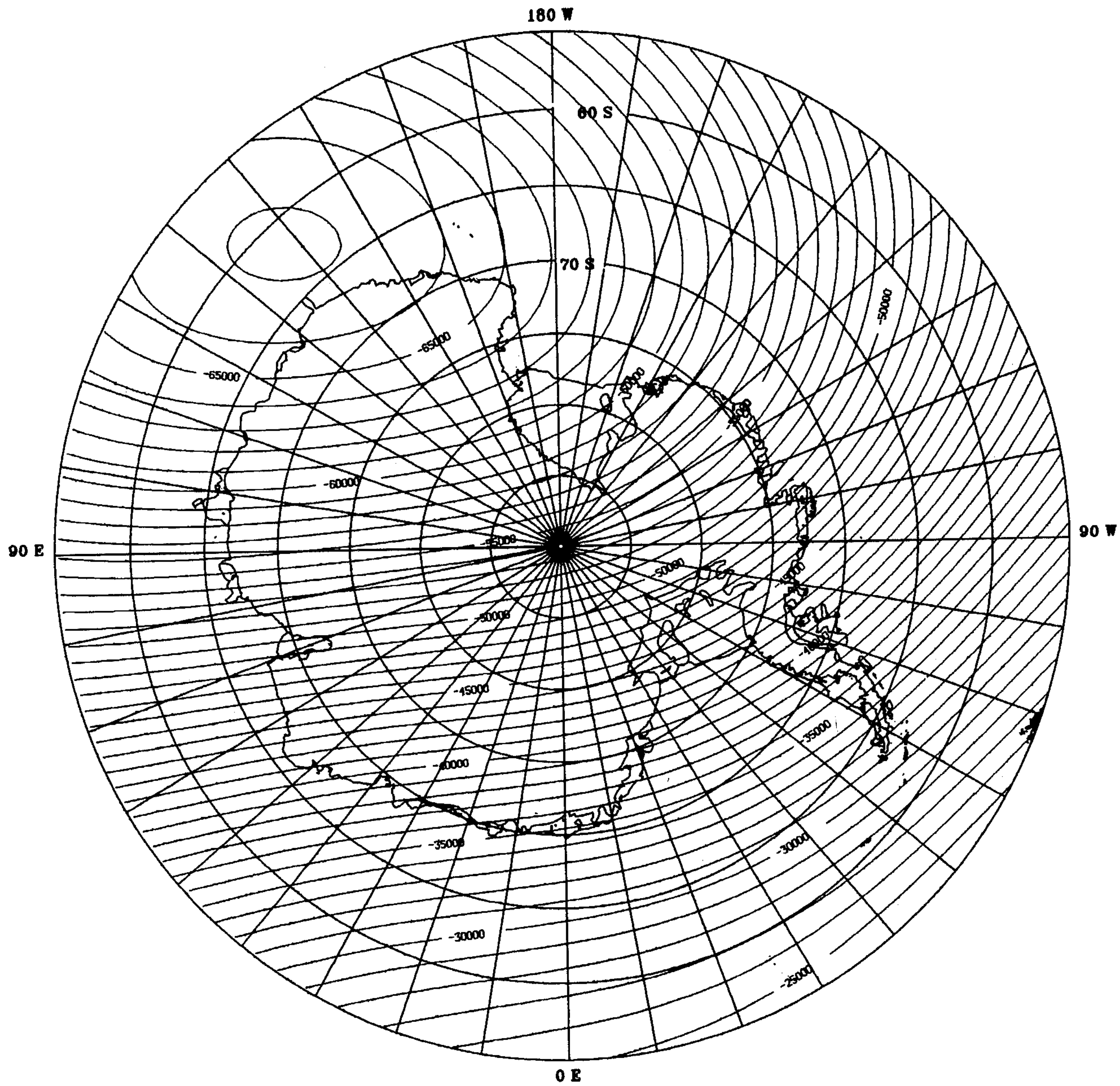
Chart 84. Inclination ($\dot{I}$)



1997.5 at surface of WGS-84 reference ellipsoid.

units: minutes/yr

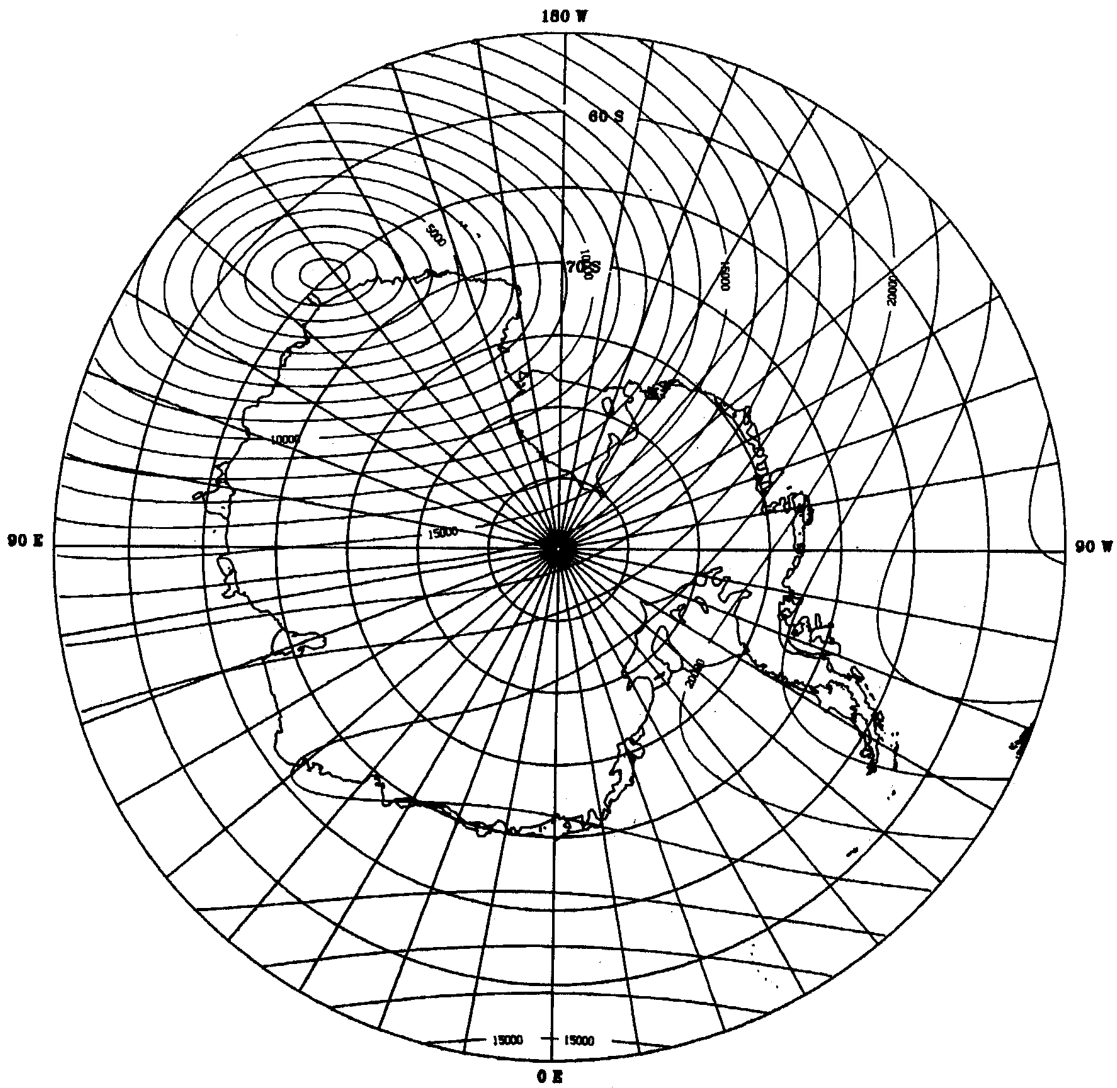
Chart 85. Grid Variation ($\dot{GV}$)



1995.0 at surface of WGS-84 reference ellipsoid.

units: nT

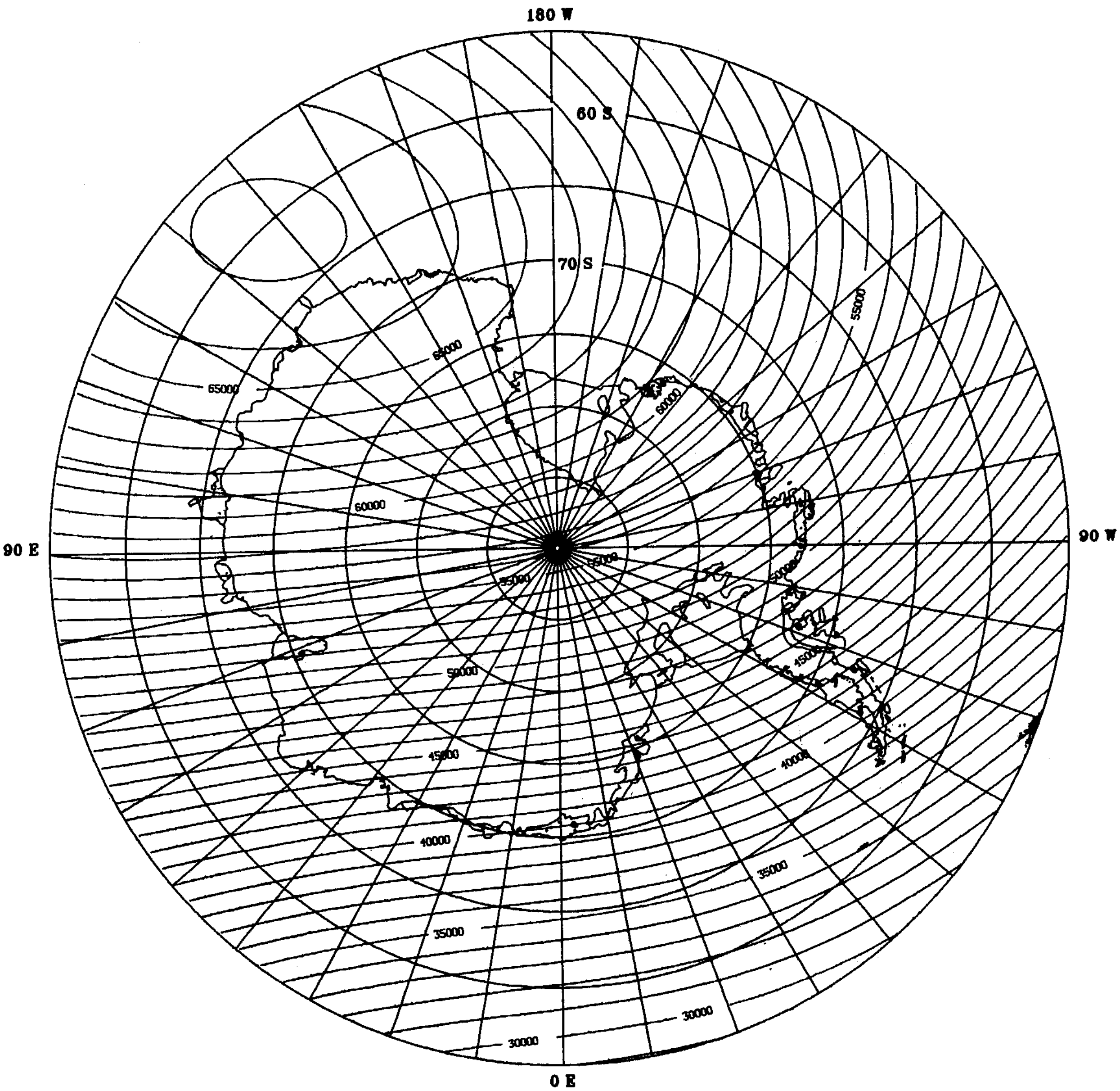
Chart 86. Vertical Component (Z)



1995.0 at surface of WGS-84 reference ellipsoid.

units: nT

Chart 87. Horizontal Intensity (H)



1995.0 at surface of WGS-84 reference ellipsoid.

units: nT

Chart 88. Total Intensity (F)

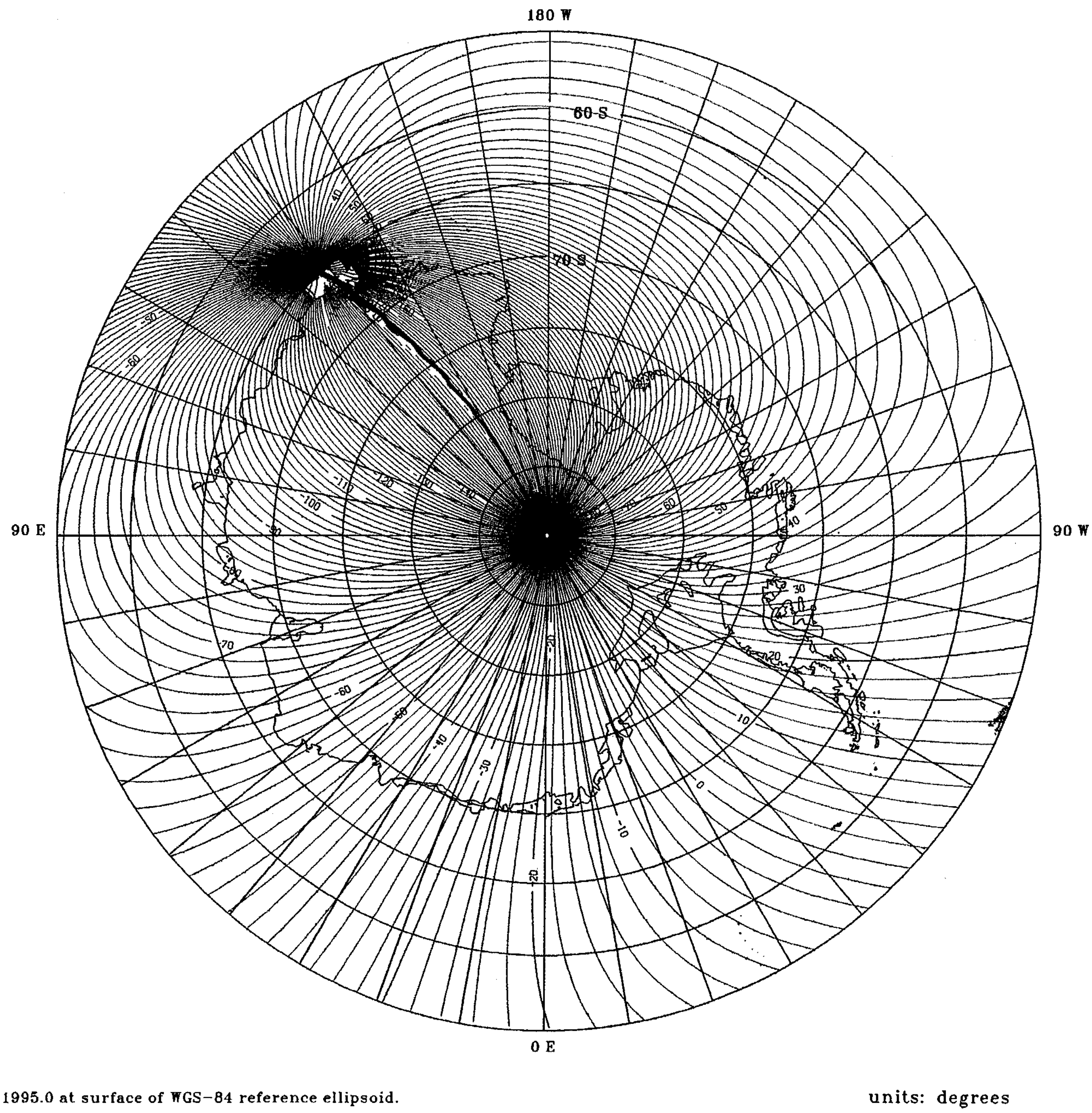
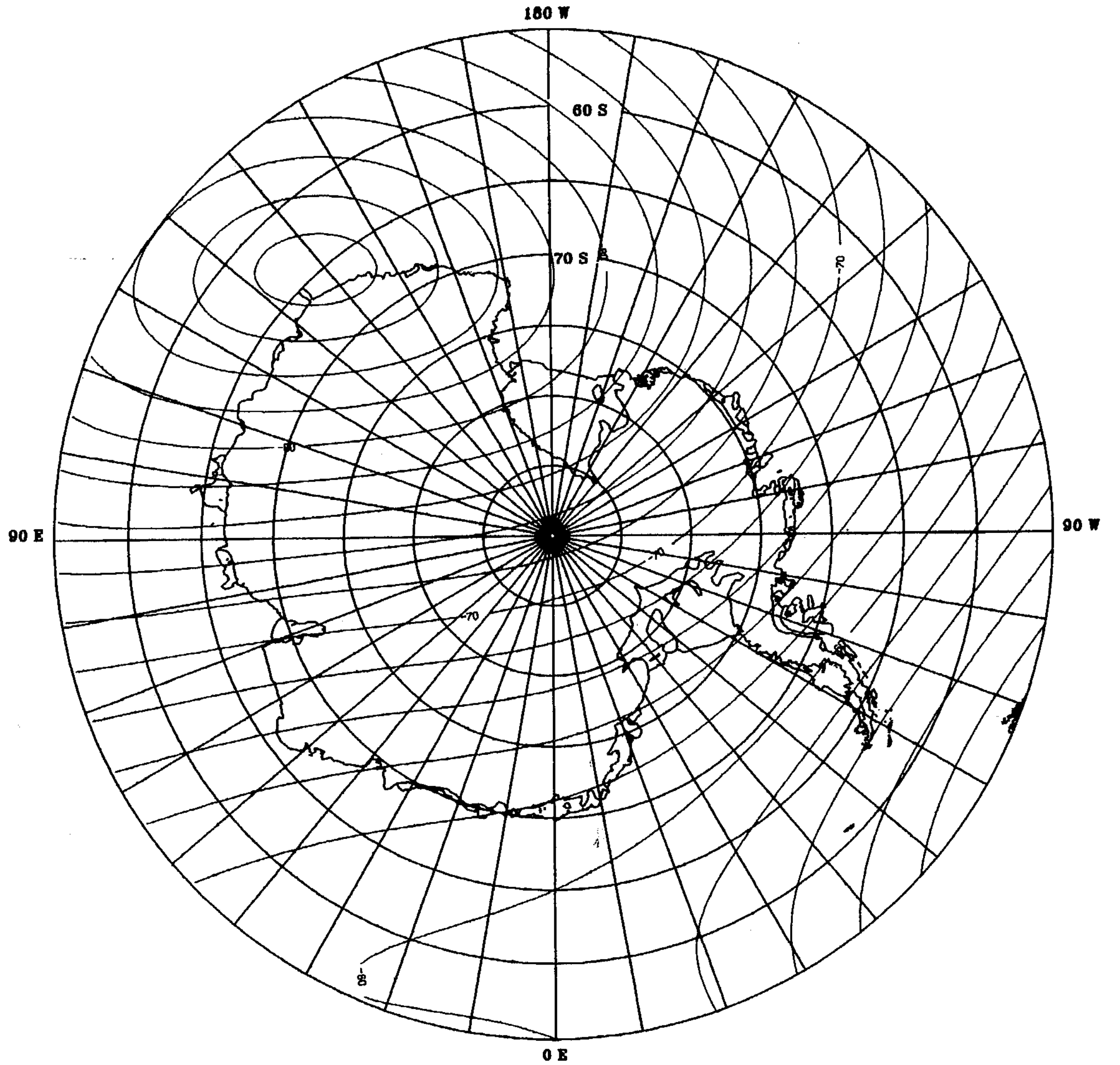


Chart 89. Declination (D)



1995.0 at surface of WGS–84 reference ellipsoid.

units: degrees

Chart 90. Inclination (I)

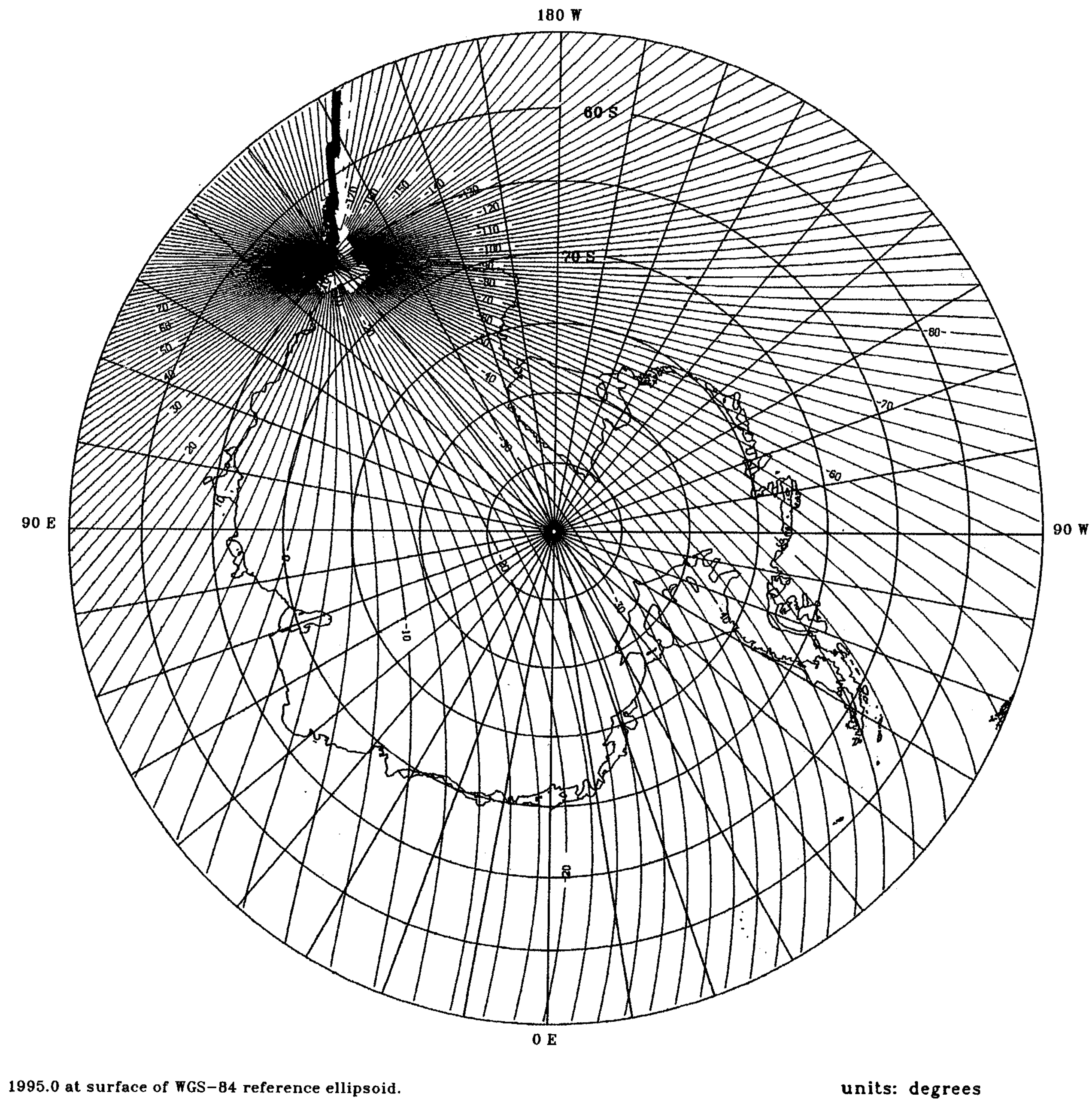
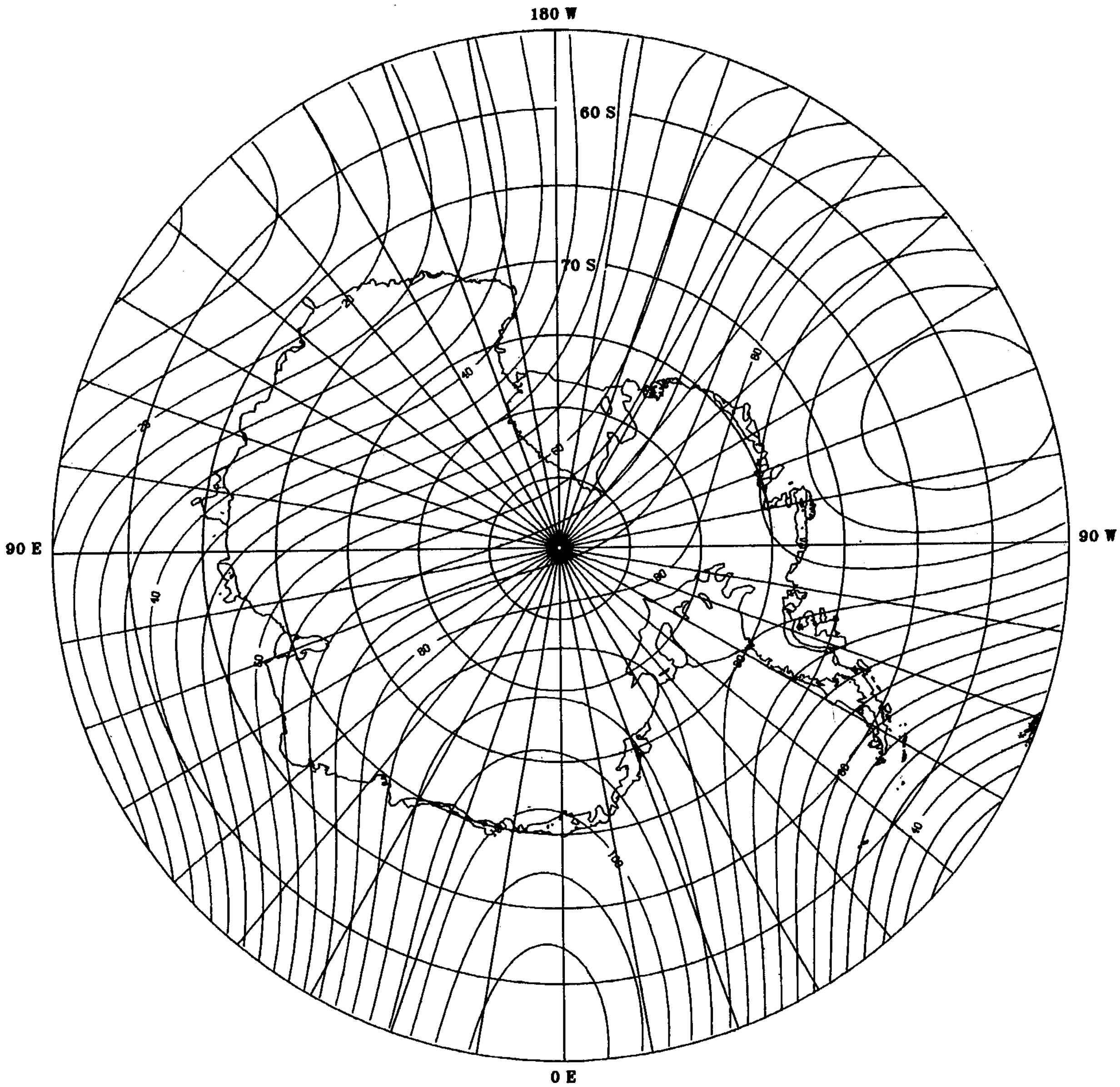


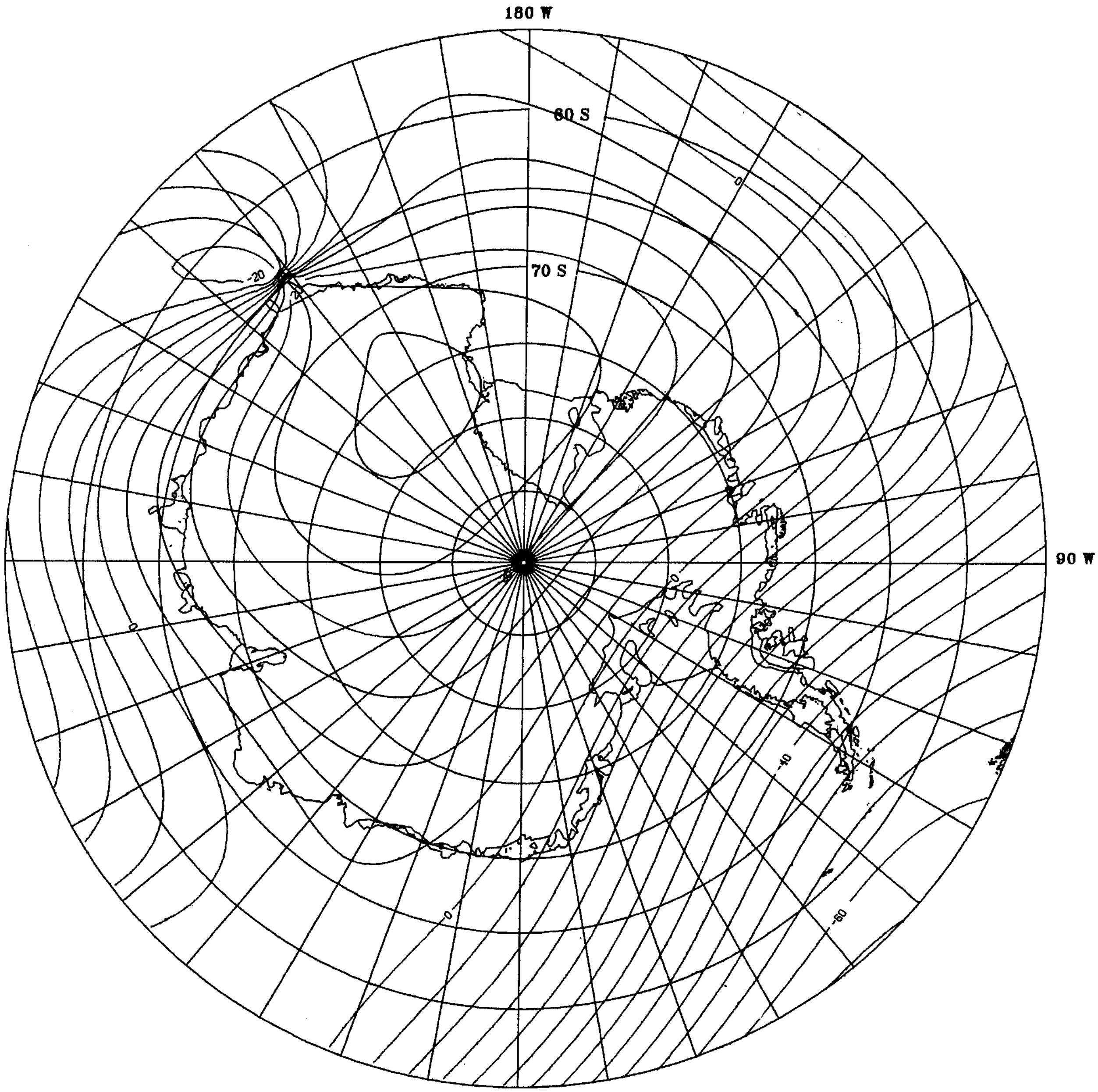
Chart 91. Grid Variation (GV)



1997.5 at surface of WGS−84 reference ellipsoid.

units: nT/yr

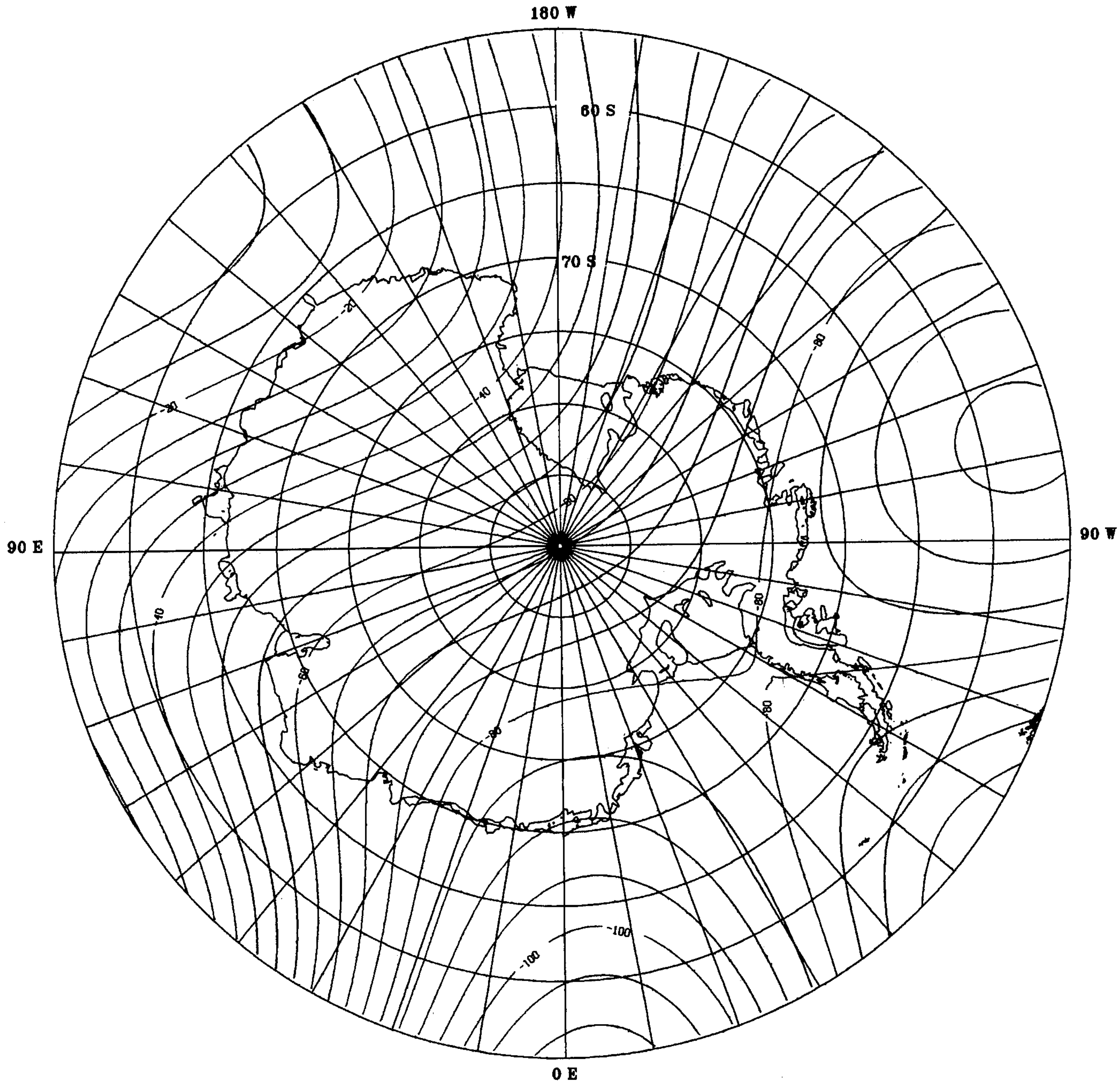
Chart 92. Vertical Component ($\dot{Z}$)



1997.5 at surface of WGS-84 reference ellipsoid.

units: nT/yr

Chart 93. Horizontal Intensity ($\dot{H}$)



1997.5 at surface of WGS-84 reference ellipsoid.

units: nT/yr

Chart 94. Total Intensity ($\dot{F}$)

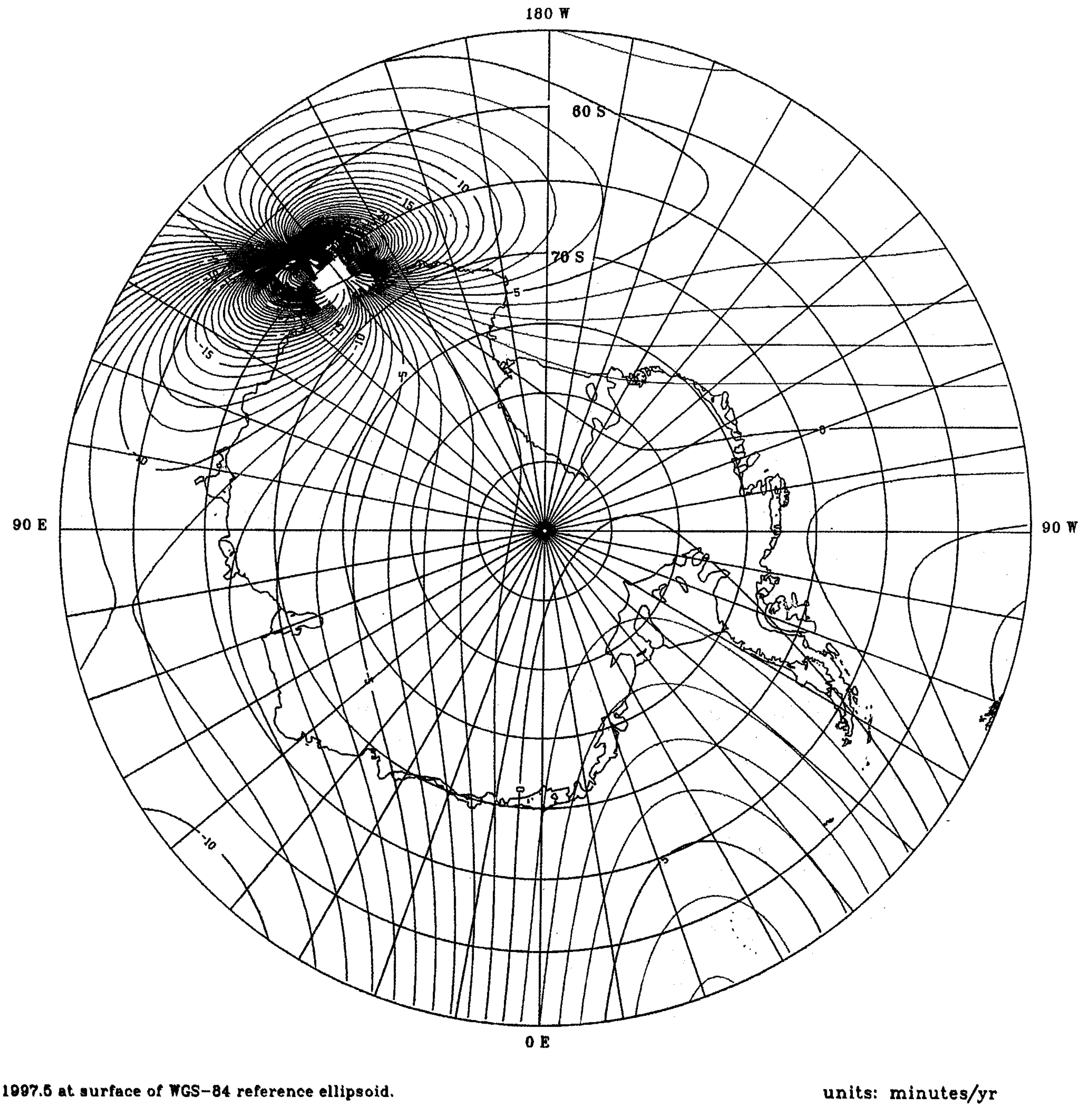
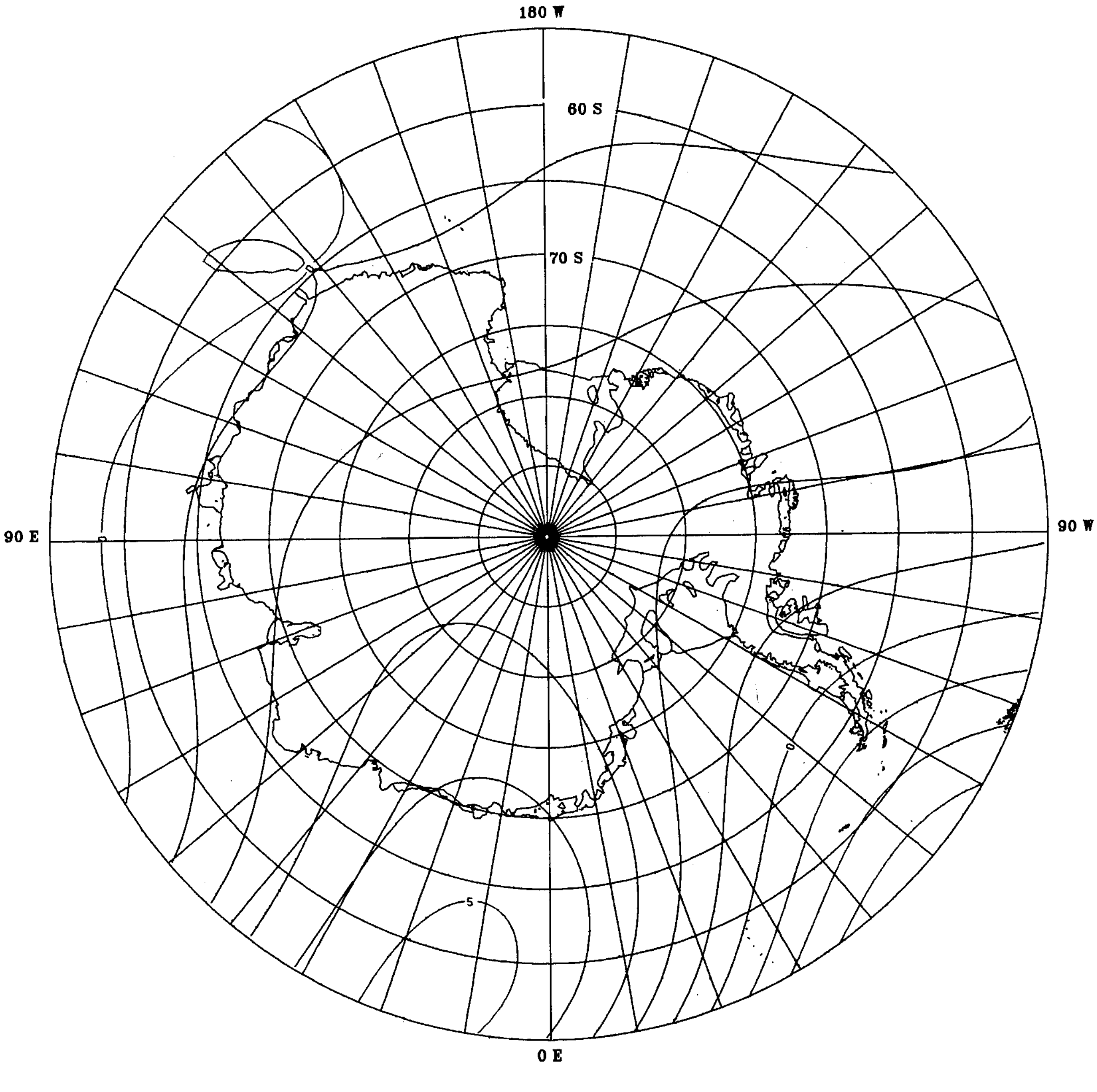


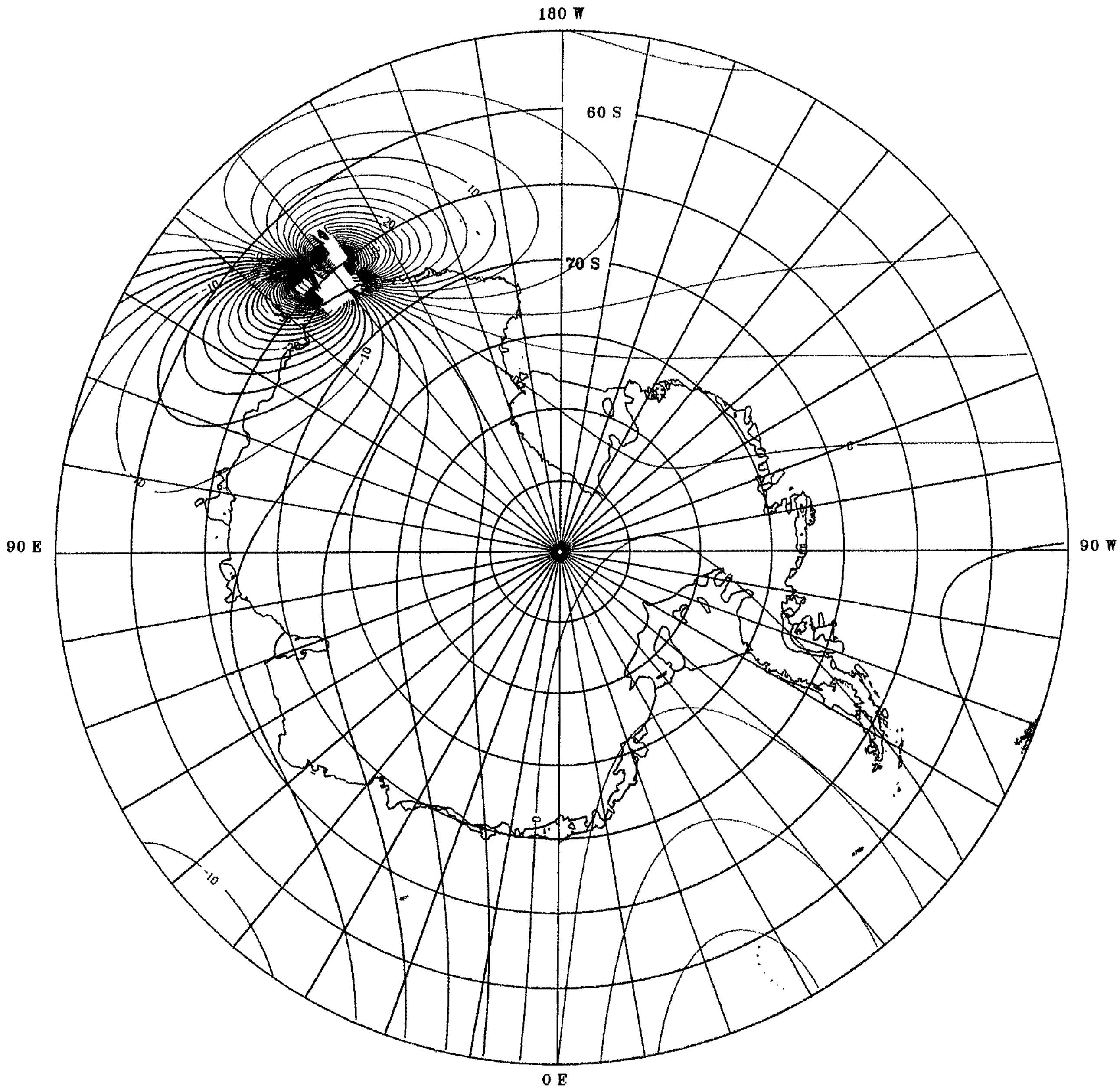
Chart 95. Declination ($\dot{D}$)



1997.5 at surface of WGS-84 reference ellipsoid.

units: minutes/yr

Chart 96. Inclination ($\dot{I}$)



1997.5 at surface of WGS-84 reference ellipsoid.

units: minutes/yr

Chart 97. Grid Variation ($\dot{GV}$)

ACKNOWLEDGEMENTS

Overall coordination and production of the joint US/UK World Magnetic Model for the 1995 Epoch (WMM-95) were the responsibilities of David R. Barraclough and Susan Macmillan of the British Geological Survey (BGS) and John M. Quinn and Rachel J. Coleman of the Naval Oceanographic Office (NAVOCEANO). Key NAVOCEANO Senior Scientists responsible for planning and executing the Project MAGNET survey flights were Virgil Bettencourt, Donald Wilson, Fred Valentine, and Jesus Anglero. The calibration and processing of aeromagnetic data are complicated affairs. Key geophysicists concerned with this aspect of Project MAGNET data analyses were John Nigro, Dave Irwin, and Larry McDonough. Donald Shiel was the principle geophysicist responsible for deploying and maintaining the Polar Orbiting Geomagnetic Survey (POGS) satellite ground stations and collecting, calibrating, and editing the POGS data from these stations. He also coordinated with the Defense Mapping Agency (DMA) to assure the continuous flow of accurate satellite-tracking data from DMA's tracking network, TRANET. Many other NAVOCEANO geophysicists, engineers, and technicians have been involved in the many and varied aspects of Project MAGNET and POGS data collection and data processing.

Special recognition must go to the military officers and personnel of the VXN-8 Naval Air Squadron located at the Patuxent River Naval Air Station, Maryland, who safely flew and maintained the Project MAGNET aircraft (a Lockheed RP3D Orion) during the many years of surveying covered by the data used in this and in previous US/UK World Magnetic Models.

Of course, this model could not have been produced without the tireless efforts of those many unnamed individuals around the world who collect and process magnetic field data on a day-to-day basis at the geomagnetic observatories. The Dst indices which were provided by M. Sugiura of the University of Kyoto, Japan, and the Kp indices which were provided by Helen Coffey of the National Oceanic and Atmospheric Administration's National Geophysical Data Center, World Data Center A (NOAA/NGDC/WDCA) in Boulder, Colorado, are both based on observatory data. These indices were key factors in selecting subsets of POGS data for input to this model.

A special effort has been made to preserve the several million Project MAGNET and POGS magnetic field measurements collected for use in the 1995 Epoch World Magnetic Model at NOAA/NGDC. This effort has been coordinated by Bob Jones and John Weaver of NAVOCEANO and Ronald Buhmann, Susanne McLean, and Stewart Racey of NGDC. The entire high-level data set from Project MAGNET, going back to its origins in 1951, will be placed on its own CD-ROM by NGDC, as will the entire POGS data set. Both CD-ROMs will then be made available to the general public in this convenient form through NGDC.

Many government agencies were responsible for placing the POGS satellite in space. Among these were the Office of Naval Research, the Navy Space Systems Activity, the Space Test Program, and the U.S. Air Force. The satellite itself was built by Defense Systems, Incorporated, of McLean, Virginia.

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APPENDIX

FORTRAN LISTING OF SUBROUTINE GEOMAG
WITH
INTERNAL WMM-95 MODEL COEFFICIENTS

```
C***********************************************************************
C
C
C     SUBROUTINE GEOMAG (GEOMAGNETIC FIELD COMPUTATION)
C
C
C***********************************************************************
C
C
C     WMM-95 is a Defense Mapping Agency (DMA) standard product. It is
C     covered under DMA Military Specification: MIL-W-89500 (1993).
C     For information on the use and applicability of this product contact
C
C                     DIRECTOR
C                     DEFENSE MAPPING AGENCY/HEADQUARTERS
C                     ATTN: CODE PR
C                     8613 LEE HIGHWAY
C                     FAIRFAX, VA 22031-2137
C
C
C***********************************************************************
C
C     GEOMAG PROGRAMMED BY:
C
C                         JOHN M. QUINN  7/19/90
C                         FLEET PRODUCTS DIVISION, CODE N342
C                         NAVAL OCEANOGRAPHIC OFFICE (NAVOCEANO)
C                         STENNIS SPACE CENTER (SSC), MS 39522-5001
C                         PHONE:  COM:  (601) 688-5828
C                                  AV:        485-5828
C                                 FAX:  (601) 688-5521
C
C
C***********************************************************************
C
C
C     PURPOSE:  THIS ROUTINE COMPUTES THE DECLINATION (DEC),
C               INCLINATION (DIP), TOTAL INTENSITY (TI) AND
C               GRID VARIATION (GV - POLAR REGIONS ONLY, REFERENCED
C               TO GRID NORTH OF POLAR STEREOGRAPHIC PROJECTION) OF
C               THE EARTH'S MAGNETIC FIELD IN GEODETIC COORDINATES
C               FROM THE COEFFICIENTS OF THE CURRENT OFFICIAL
C               DEPARTMENT OF DEFENSE (DOD) SPHERICAL HARMONIC WORLD
C               MAGNETIC MODEL (WMM-95).  THE WMM SERIES OF MODELS IS
C               UPDATED EVERY 5 YEARS ON JANUARY 1'ST OF THOSE YEARS
C               WHICH ARE DIVISIBLE BY 5 (I.E. 1980, 1985, 1990 ETC.)
C               BY THE NAVAL OCEANOGRAPHIC OFFICE IN COOPERATION
C               WITH THE BRITISH GEOLOGICAL SURVEY (BGS).  THE MODEL
C               IS BASED ON GEOMAGNETIC SURVEY MEASUREMENTS FROM
C               AIRCRAFT, SATELLITE AND GEOMAGNETIC OBSERVATORIES.
C
C
C***********************************************************************
C
C
C     MODEL:    THE WMM SERIES GEOMAGNETIC MODELS ARE COMPOSED
C               OF TWO PARTS:  THE MAIN FIELD MODEL, WHICH IS
C               VALID AT THE BASE EPOCH OF THE CURRENT MODEL AND
C               A SECULAR VARIATION MODEL, WHICH ACCOUNTS FOR SLOW
C               TEMPORAL VARIATIONS IN THE MAIN GEOMAGNETIC FIELD
C               FROM THE BASE EPOCH TO A MAXIMUM OF 5 YEARS BEYOND
C               THE BASE EPOCH.  FOR EXAMPLE, THE BASE EPOCH OF
C               THE WMM-95 MODEL IS 1995.0.  THIS MODEL IS THEREFORE
C               CONSIDERED VALID BETWEEN 1995.0 AND 2000.0. THE
C               COMPUTED MAGNETIC PARAMETERS ARE REFERENCED TO THE
C               WGS-84 ELLIPSOID.
C
C
C***********************************************************************
C
C
```

```
C     ACCURACY:  IN OCEAN AREAS AT THE EARTH'S SURFACE OVER THE
C                ENTIRE 5 YEAR LIFE OF A DEGREE AND ORDER 12
C                SPHERICAL HARMONIC MODEL SUCH AS WMM-95, THE ESTIMATED
C                RMS ERRORS FOR THE VARIOUS MAGENTIC COMPONENTS ARE:
C
C                 DEC  -   0.5 Degrees
C                 DIP  -   0.5 Degrees
C                 TI   - 280.0 nanoTeslas (nT)
C                 GV   -   0.5 Degrees
C
C                OTHER MAGNETIC COMPONENTS THAT CAN BE DERIVED FROM
C                THESE FOUR BY SIMPLE TRIGONOMETRIC RELATIONS WILL
C                HAVE THE FOLLOWING APPROXIMATE ERRORS OVER OCEAN AREAS:
C
C                 X    - 140 nT (North)
C                 Y    - 140 nT (East)
C                 Z    - 200 nT (Vertical)  Positive is down
C                 H    - 200 nT (Horizontal)
C
C                OVER LAND THE RMS ERRORS ARE EXPECTED TO BE SOMEWHAT
C                HIGHER, ALTHOUGH THE RMS ERRORS FOR DEC, DIP AND GV
C                ARE STILL ESTIMATED TO BE LESS THAN 1.0 DEGREE, FOR
C                THE ENTIRE 5-YEAR LIFE OF THE MODEL AT THE EARTH's
C                SURFACE.  THE OTHER COMPONENT ERRORS OVER LAND ARE
C                MORE DIFFICULT TO ESTIMATE AND SO ARE NOT GIVEN.
C
C                THE ACCURACY AT ANY GIVEN TIME OF ALL FOUR
C                GEOMAGNETIC PARAMETERS DEPENDS ON THE GEOMAGNETIC
C                LATITUDE.  THE ERRORS ARE LEAST AT THE EQUATOR AND
C                GREATEST AT THE MAGNETIC POLES.
C
C                IT IS VERY IMPORTANT TO NOTE THAT A DEGREE AND
C                 ORDER 12 MODEL, SUCH AS WMM-95, DESCRIBES ONLY
C                THE LONG WAVELENGTH SPATIAL MAGNETIC FLUCTUATIONS
C                DUE TO EARTH'S CORE.  NOT INCLUDED IN THE WMM SERIES
C                MODELS ARE INTERMEDIATE AND SHORT WAVELENGTH
C                SPATIAL FLUCTUATIONS OF THE GEOMAGNETIC FIELD
C                WHICH ORIGINATE IN THE EARTH'S MANTLE AND CRUST.
C                CONSEQUENTLY, ISOLATED ANGULAR ERRORS AT VARIOUS
C                POSITIONS ON THE SURFACE (PRIMARILY OVER LAND, IN
C                CONTINENTAL MARGINS AND OVER OCEANIC SEAMOUNTS,
C                RIDGES AND TRENCHES) OF SEVERAL DEGREES MAY BE
C                EXPECTED. ALSO NOT INCLUDED IN THE MODEL ARE
C                NONSECULAR TEMPORAL FLUCTUATIONS OF THE GEOMAGNETIC
C                FIELD OF MAGNETOSPHERIC AND IONOSPHERIC ORIGIN.
C                DURING MAGNETIC STORMS, TEMPORAL FLUCTUATIONS CAN
C                CAUSE SUBSTANTIAL DEVIATIONS OF THE GEOMAGNETIC
C                FIELD FROM MODEL VALUES.  IN ARCTIC AND ANTARCTIC
C                REGIONS, AS WELL AS IN EQUATORIAL REGIONS, DEVIATIONS
C                FROM MODEL VALUES ARE BOTH FREQUENT AND PERSISTENT.
C
C                IF THE REQUIRED DECLINATION ACCURACY IS MORE
C                STRINGENT THAN THE WMM SERIES OF MODELS PROVIDE, THEN
C                THE USER IS ADVISED TO REQUEST SPECIAL (REGIONAL OR
C                LOCAL) SURVEYS BE PERFORMED AND MODELS PREPARED BY
C                NAVOCEANO, WHICH OPERATES THE PROJECT MAGNET
C                AIRCRAFT AND THE POLAR ORBITING GEOMAGNETIC SURVEY
C                (POGS) SATELLITE.  REQUESTS OF THIS NATURE SHOULD
C                BE MADE THROUGH DMA AT THE ADDRESS ABOVE.
C
C
C***********************************************************************
C
C
C     USAGE:  THIS ROUTINE IS BROKEN UP INTO TWO PARTS:
C
C             A) AN INITIALIZATION MODULE, WHICH IS CALLED ONLY
C                ONCE AT THE BEGINNING OF THE MAIN (CALLING)
C                PROGRAM
C             B) A PROCESSING MODULE, WHICH COMPUTES THE MAGNETIC
C                FIELD PARAMETERS FOR EACH SPECIFIED GEODETIC
```

```
C              POSITION (ALTITUDE, LATITUDE, LONGITUDE) AND TIME
C
C           INITIALIZATION IS MADE VIA A SINGLE CALL TO THE MAIN
C           ENTRY POINT (GEOMAG), WHILE SUBSEQUENT PROCESSING
C           CALLS ARE MADE THROUGH THE SECOND ENTRY POINT (GEOMG1).
C           ONE CALL TO THE PROCESSING MODULE IS REQUIRED FOR EACH
C           POSITION AND TIME.
C
C           THE VARIABLE MAXDEG IN THE INITIALIZATION CALL IS THE
C           MAXIMUM DEGREE TO WHICH THE SPHERICAL HARMONIC MODEL
C           IS TO BE COMPUTED.  IT MUST BE SPECIFIED BY THE USER
C           IN THE CALLING ROUTINE.  NORMALLY IT IS 12 BUT IT MAY
C           BE SET LESS THAN 12 TO INCREASE COMPUTATIONAL SPEED AT
C           THE EXPENSE OF REDUCED ACCURACY.
C
C           THE PC VERSION OF THIS SUBROUTINE MUST BE COMPILED
C           WITH A FORTRAN 77 COMPATIBLE COMPILER SUCH AS THE
C           MICROSOFT OPTIMIZING FORTRAN COMPILER VERSION 4.1
C           OR LATER.
C
C
C**********************************************************************
C
C
C     REFERENCES:
C
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C            JOHN M. NIGRO; THE JOINT US/UK 1995 EPOCH WORLD
C            MAGNETIC MODEL, TECHNICAL REPORT NO. 314, NAVAL
C            OCEANOGRAPHIC OFFICE (1995)
C
C
C**********************************************************************
C
C
C     PARAMETER DESCRIPTIONS:
C
C       A      - SEMIMAJOR AXIS OF WGS-84 ELLIPSOID (KM)
C       B      - SEMIMINOR AXIS OF WGS-84 ELLIPSOID (KM)
C       RE     - MEAN RADIUS OF IAU-66 ELLIPSOID (KM)
C       SNORM  - SCHMIDT NORMALIZATION FACTORS
C       C      - GAUSS COEFFICIENTS OF MAIN GEOMAGNETIC MODEL (NT)
C       CD     - GAUSS COEFFICIENTS OF SECULAR GEOMAGNETIC MODEL (NT/YR)
C       TC     - TIME ADJUSTED GEOMAGNETIC GAUSS COEFFICIENTS (NT)
C       OTIME  - TIME ON PREVIOUS CALL TO GEOMAG (YRS)
C       OALT   - GEODETIC ALTITUDE ON PREVIOUS CALL TO GEOMAG (YRS)
C       OLAT   - GEODETIC LATITUDE ON PREVIOUS CALL TO GEOMAG (DEG.)
```

```
C       OLON   - GEODETIC LONGITUDE ON PREVIOUS CALL TO GEOMAG (DEG.)
C       TIME   - COMPUTATION TIME (YRS)                        (INPUT)
C                (EG. 1 JULY 1995 = 1995.500)
C       ALT    - GEODETIC ALTITUDE (KM)                        (INPUT)
C       GLAT   - GEODETIC LATITUDE (DEG.)                      (INPUT)
C       GLON   - GEODETIC LONGITUDE (DEG.)                     (INPUT)
C       EPOCH  - BASE TIME OF GEOMAGNETIC MODEL (YRS)
C       DTR    - DEGREE TO RADIAN CONVERSION
C       SP(M)  - SINE OF (M*SPHERICAL COORD. LONGITUDE)
C       CP(M)  - COSINE OF (M*SPHERICAL COORD. LONGITUDE)
C       ST     - SINE OF (SPHERICAL COORD. LATITUDE)
C       CT     - COSINE OF (SPHERICAL COORD. LATITUDE)
C       R      - SPHERICAL COORDINATE RADIAL POSITION (KM)
C       CA     - COSINE OF SPHERICAL TO GEODETIC VECTOR ROTATION ANGLE
C       SA     - SINE OF SPHERICAL TO GEODETIC VECTOR ROTATION ANGLE
C       BR     - RADIAL COMPONENT OF GEOMAGNETIC FIELD (NT)
C       BT     - THETA COMPONENT OF GEOMAGNETIC FIELD (NT)
C       BP     - PHI COMPONENT OF GEOMAGNETIC FIELD (NT)
C       P(N,M) - ASSOCIATED LEGENDRE POLYNOMIALS (UNNORMALIZED)
C       PP(N)  - ASSOCIATED LEGENDRE POLYNOMIALS FOR M=1 (UNNORMALIZED)
C       DP(N,M)- THETA DERIVATIVE OF P(N,M) (UNNORMALIZED)
C       BX     - NORTH GEOMAGNETIC COMPONENT (NT)
C       BY     - EAST GEOMAGNETIC COMPONENT (NT)
C       BZ     - VERTICALLY DOWN GEOMAGNETIC COMPONENT (NT)
C       BH     - HORIZONTAL GEOMAGNETIC COMPONENT (NT)
C       DEC    - GEOMAGNETIC DECLINATION (DEG.)                (OUTPUT)
C                  EAST=POSITIVE ANGLES
C                  WEST=NEGATIVE ANGLES
C       DIP    - GEOMAGNETIC INCLINATION (DEG.)                (OUTPUT)
C                  DOWN=POSITIVE ANGLES
C                    UP=NEGATIVE ANGLES
C       TI     - GEOMAGNETIC TOTAL INTENSITY (NT)              (OUTPUT)
C       GV     - GEOMAGNETIC GRID VARIATION (DEG.)             (OUTPUT)
C                REFERENCED TO GRID NORTH
C                GRID NORTH REFERENCED TO 0 MERIDIAN
C                OF A POLAR STEREOGRAPHIC PROJECTION
C                (ARCTIC/ANTARCTIC ONLY)
C       MAXDEG - MAXIMUM DEGREE OF SPHERICAL HARMONIC MODEL    (INPUT)
C       MOXORD - MAXIMUM ORDER OF SPHERICAL HARMONIC MODEL
C
C
C***********************************************************************
C
C
C     NOTE:  THIS VERSION OF GEOMAG USES THE WMM-95 GEOMAGNETIC
C            MODEL REFERENCED TO THE WGS-84 GRAVITY MODEL ELLIPSOID
C
C
C***********************************************************************
C
C
C
C
C
C
C
C
C
C***********************************************************************
C
C
C                      INITIALIZATION MODULE
C
C
C***********************************************************************
C
C
      SUBROUTINE GEOMAG(MAXDEG)
C
C
      DIMENSION C(0:12,0:12),CD(0:12,0:12),TC(0:12,0:12)
```

```
      DIMENSION P(0:12,0:12),DP(0:12,0:12),SNORM(0:12,0:12)
      DIMENSION SP(0:12),CP(0:12),FN(0:12),FM(0:12),PP(0:12)
      REAL K(0:12,0:12)
      EQUIVALENCE (SNORM,P)
C
C
      DATA EPOCH/1995.0/
C
C
      DATA C/     0.0,-29682.1, -2194.7,   1318.8,   940.0,  -209.5,
     *           68.5,     78.0,    24.7,      2.9,    -2.9,     1.7,
     *           -1.8,   5315.6, -1782.2,   3078.6, -2273.6,   782.9,
     *          354.0,     65.6,   -68.1,      3.4,     7.5,    -3.3,
     *           -1.6,      0.9, -2359.1,   -418.6,  1685.7,  1246.9,
     *          290.9,    238.2,    64.1,      0.1,    -1.5,     0.4,
     *            2.8,     -3.6,    -0.1,   -261.1,   301.0,  -416.5,
     *          766.3,   -418.9,  -122.1,   -169.1,    29.6,    -9.6,
     *          -10.3,     -4.3,     1.2,     -0.5,   259.4,  -230.9,
     *           99.8,   -306.1,   113.8,   -162.8,    -0.5,     6.0,
     *          -16.5,      9.7,    -3.1,     -0.6,     0.8,    43.7,
     *          157.6,   -150.1,   -59.2,    104.4,   -23.3,    16.5,
     *            8.7,      2.6,    -2.3,      2.4,     0.1,     0.2,
     *          -15.2,     74.3,    69.4,    -55.3,     3.0,    33.3,
     *          -91.0,      9.2,     3.6,     -2.4,     2.8,    -0.7,
     *            0.5,    -76.1,   -24.5,      1.6,    20.0,    16.5,
     *          -23.6,     -6.8,    -2.4,     -4.9,     6.8,     0.7,
     *           -0.8,      0.4,    14.9,    -19.5,     6.3,   -20.4,
     *           12.2,      7.0,   -19.0,     -8.8,    -8.5,    -0.5,
     *            4.1,      1.3,    -0.4,    -19.8,    14.6,    10.9,
     *           -7.5,     -6.8,     9.3,      7.7,    -8.1,     2.6,
     *           -6.5,      3.6,    -0.3,      0.3,     3.2,     1.7,
     *            2.9,      5.6,    -3.4,     -0.7,    -2.9,     2.3,
     *           -1.6,     -6.6,     0.6,      2.2,     0.2,     0.3,
     *            1.0,     -3.6,    -1.4,      1.9,     0.2,    -1.3,
     *           -2.4,     -0.6,    -2.2,      1.3,     4.2,     0.4,
     *            0.3,      1.4,     0.8,     -3.0,     0.7,     0.5,
     *           -0.8,      0.6,     0.1,     -1.3,    -0.4,     0.9,
     *            0.6/
C
C
      DATA CD/     0.0, 17.6,-13.7,  0.8,  1.2,  0.9,  0.4, -0.3,
     *             0.1,  0.0,  0.0,  0.0,  0.0,-18.0, 13.2,  4.0,
     *            -6.6,  1.1,  0.5, -0.3, -1.1,  0.0,  0.0,  0.0,
     *             0.0,  0.0,-14.6, -7.2, -0.3, -0.5, -6.8, -1.4,
     *             0.3, -0.5,  0.4,  0.0,  0.0,  0.0,  0.0,  4.0,
     *             2.2,-12.6, -8.5,  0.3, -1.7,  2.1,  0.5,  0.3,
     *             0.0,  0.0,  0.0,  0.0,  1.3,  1.0,  2.5, -1.2,
     *            -4.5,  0.0,  0.0,  1.3, -1.3,  0.0,  0.0,  0.0,
     *             0.0,  0.5,  1.5,  0.6,  1.7,  0.6,  2.1, -0.4,
     *             0.1,  0.5,  0.0,  0.0,  0.0,  0.0,  0.7, -1.5,
     *            -0.5, -0.7,  1.1,  2.6, -0.4,  0.0,  0.4,  0.0,
     *             0.0,  0.0,  0.0,  0.3,  0.0,  0.7, -0.6,  0.1,
     *            -0.6, -0.4, -0.9, -0.9,  0.0,  0.0,  0.0,  0.0,
     *             0.4, -0.3,  0.1,  0.8, -0.1, -1.3, -0.9, -1.1,
     *             0.1, 56*0.0/
C
C
C
C
C
C         INITIALIZE CONSTANTS
C
C
      IF (MAXDEG .GT. 12) MAXDEG=12
      MAXORD=MAXDEG
      PI=3.14159265359
      DTR=PI/180.0
      SP(0)=0.
      CP(0)=1.
      P(0,0)=1.
      PP(0)=1.
```

```
      DP(0,0)=0.
      A=6378.137
      B=6356.7523142
      RE=6371.2
      A2=A**2
      B2=B**2
      C2=A2-B2
      A4=A2**2
      B4=B2**2
      C4=A4-B4
C
C        CONVERT SCHMIDT NORMALIZED GAUSS COEFFICIENTS TO UNNORMALIZED
C
      SNORM(0,0)=1.
      DO 20 N=1,MAXORD
      SNORM(N,0)=SNORM(N-1,0)*FLOAT(2*N-1)/FLOAT(N)
      J=2
      DO 10 M=0,N
      K(N,M)=FLOAT((N-1)**2-M**2)/FLOAT((2*N-1)*(2*N-3))
      IF (M .GT. 0) THEN
      FLNMJ=FLOAT((N-M+1)*J)/FLOAT(N+M)
      SNORM(N,M)=SNORM(N,M-1)*SQRT(FLNMJ)
      J=1
      C(M-1,N)=SNORM(N,M)*C(M-1,N)
      CD(M-1,N)=SNORM(N,M)*CD(M-1,N)
      ENDIF
      C(N,M)=SNORM(N,M)*C(N,M)
      CD(N,M)=SNORM(N,M)*CD(N,M)
   10 CONTINUE
      FN(N)=FLOAT(N+1)
      FM(N)=FLOAT(N)
   20 CONTINUE
      K(1,1)=0.
C
C
      OTIME=-1000.
      OALT=-1000.
      OLAT=-1000.
      OLON=-1000.
C
C
      RETURN
C
C
C*************************************************************************
C
C
C                          PROCESSING MODULE
C
C
C*************************************************************************
C
C
      ENTRY GEOMG1(ALT,GLAT,GLON,TIME,DEC,DIP,TI,GV)
C
C
      DT=TIME-EPOCH
      IF (OTIME .LT. 0. .AND. (DT .LT. 0. .OR. DT .GT. 5.)) THEN
      PRINT *, '       '
      PRINT *, ' WARNING - TIME EXTENDS BEYOND MODEL 5-YEAR LIFE SPAN'
      PRINT *, ' CONTACT DMA FOR PRODUCT UPDATES:'
      PRINT *, '       '
      PRINT *, '        DEFENSE MAPPING AGENCY'
      PRINT *, '        ATTN: Code PRS'
      PRINT *, '        8613 LEE HIGHWAY'
      PRINT *, '        FAIRFAX, VA 22031-2137'
      PRINT *, '        (703)285-9197, AUTOVON 356-9197'
      PRINT *, '       '
      PRINT *, ' EPOCH  = ',EPOCH
      PRINT *, ' TIME   = ',TIME
      ENDIF
```

```
C
C
      RLON=GLON*DTR
      RLAT=GLAT*DTR
      SRLON=SIN(RLON)
      SRLAT=SIN(RLAT)
      CRLON=COS(RLON)
      CRLAT=COS(RLAT)
      SRLON2=SRLON**2
      SRLAT2=SRLAT**2
      CRLON2=CRLON**2
      CRLAT2=CRLAT**2
      SP(1)=SRLON
      CP(1)=CRLON
C
C        CONVERT FROM GEODETIC COORDS. TO SPHERICAL COORDS.
C
      IF (ALT .NE. OALT .OR. GLAT .NE. OLAT) THEN
      Q=SQRT(A2-C2*SRLAT2)
      Q1=ALT*Q
      Q2=((Q1+A2)/(Q1+B2))**2
      CT=SRLAT/SQRT(Q2*CRLAT2+SRLAT2)
      ST=SQRT(1.0-CT**2)
      R2=ALT**2+2.0*Q1+(A4-C4*SRLAT2)/Q**2
      R=SQRT(R2)
      D=SQRT(A2*CRLAT2+B2*SRLAT2)
      CA=(ALT+D)/R
      SA=C2*CRLAT*SRLAT/(R*D)
      ENDIF
C
C
      IF (GLON .NE. OLON) THEN
      DO 40 M=2,MAXORD
      SP(M)=SP(1)*CP(M-1)+CP(1)*SP(M-1)
      CP(M)=CP(1)*CP(M-1)-SP(1)*SP(M-1)
   40 CONTINUE
      ENDIF
C
C
      AOR=RE/R
      AR=AOR**2
C
C
      BR=0.
      BT=0.
      BP=0.
      BPP=0.
C
C
      DO 70 N=1,MAXORD
      AR=AR*AOR
      DO 60 M=0,N
C
C        COMPUTE UNNORMALIZED ASSOCIATED LEGENDRE POLYNOMIALS
C        AND DERIVATIVES VIA RECURSION RELATIONS
C
      IF (ALT .NE. OALT .OR. GLAT .NE. OLAT) THEN
      IF (N .EQ. M) THEN
      P(N,M)=ST*P(N-1,M-1)
      DP(N,M)=ST*DP(N-1,M-1)+CT*P(N-1,M-1)
      GO TO 50
      ENDIF
      IF (N .EQ. 1 .AND. M .EQ. 0) THEN
      P(N,M)=CT*P(N-1,M)
      DP(N,M)=CT*DP(N-1,M)-ST*P(N-1,M)
      GO TO 50
      ENDIF
      IF (N .GT. 1 .AND. N .NE. M) THEN
      IF (M .GT. N-2) P(N-2,M)=0.0
      IF (M .GT. N-2) DP(N-2,M)=0.0
      P(N,M)=CT*P(N-1,M)-K(N,M)*P(N-2,M)
```

```
      DP(N,M)=CT*DP(N-1,M)-ST*P(N-1,M)-K(N,M)*DP(N-2,M)
      ENDIF
      ENDIF
   50 CONTINUE
C
C        TIME ADJUST THE GAUSS COEFFICIENTS
C
      IF (TIME .NE. OTIME) THEN
      TC(N,M)=C(N,M)+DT*CD(N,M)
      IF (M .NE. 0) THEN
      TC(M-1,N)=C(M-1,N)+DT*CD(M-1,N)
      ENDIF
      ENDIF
C
C        ACCUMULATE TERMS OF THE SPHERICAL HARMONIC EXPANSIONS
C
      PAR=AR*P(N,M)
      IF (M .EQ. 0) THEN
      TEMP1=TC(N,M)*CP(M)
      TEMP2=TC(N,M)*SP(M)
      ELSE
      TEMP1=TC(N,M)*CP(M)+TC(M-1,N)*SP(M)
      TEMP2=TC(N,M)*SP(M)-TC(M-1,N)*CP(M)
      ENDIF
      BT=BT-AR*TEMP1*DP(N,M)
      BP=BP+FM(M)*TEMP2*PAR
      BR=BR+FN(N)*TEMP1*PAR
C
C         SPECIAL CASE:  NORTH/SOUTH GEOGRAPHIC POLES
C
      IF (ST .EQ. 0.0 .AND. M .EQ. 1) THEN
      IF (N .EQ. 1) THEN
      PP(N)=PP(N-1)
      ELSE
      PP(N)=CT*PP(N-1)-K(N,M)*PP(N-2)
      ENDIF
      PARP=AR*PP(N)
      BPP=BPP+FM(M)*TEMP2*PARP
      ENDIF
C
C
   60 CONTINUE
   70 CONTINUE
C
C
      IF (ST .EQ. 0.0) THEN
      BP=BPP
      ELSE
      BP=BP/ST
      ENDIF
C
C        ROTATE MAGNETIC VECTOR COMPONENTS FROM SPHERICAL TO
C        GEODETIC COORDINATES
C
      BX=-BT*CA-BR*SA
      BY=BP
      BZ=BT*SA-BR*CA
C
C        COMPUTE DECLINATION (DEC), INCLINATION (DIP) AND
C        TOTAL INTENSITY (TI)
C
      BH=SQRT(BX**2+BY**2)
      TI=SQRT(BH**2+BZ**2)
      DEC=ATAN2(BY,BX)/DTR
      DIP=ATAN2(BZ,BH)/DTR
C
C        COMPUTE MAGNETIC GRID VARIATION IF THE CURRENT
C        GEODETIC POSITION IS IN THE ARCTIC OR ANTARCTIC
C        (I.E. GLAT > +55 DEGREES OR GLAT < -55 DEGREES)
C
C        OTHERWISE, SET MAGNETIC GRID VARIATION TO -999.0
```

```
C
      GV=-999.0
      IF (ABS(GLAT) .GE. 55.) THEN
      IF (GLAT .GT. 0. .AND. GLON .GE. 0.) GV=DEC-GLON
      IF (GLAT .GT. 0. .AND. GLON .LT. 0.) GV=DEC+ABS(GLON)
      IF (GLAT .LT. 0. .AND. GLON .GE. 0.) GV=DEC+GLON
      IF (GLAT .LT. 0. .AND. GLON .LT. 0.) GV=DEC-ABS(GLON)
      IF (GV .GT. +180.) GV=GV-360.
      IF (GV .LT. -180.) GV=GV+360.
      ENDIF
C
C
      OTIME=TIME
      OALT=ALT
      OLAT=GLAT
      OLON=GLON
C
C
      RETURN
C
C
      END
```

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